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1918

THE  
F-5L FLYING BOAT  
HANDBOOK

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NAVY DEPARTMENT  
BUREAU OF CONSTRUCTION AND REPAIR

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DECEMBER, 1918





Class TL 684

Book .U<sup>2</sup> 6

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# THE F-5L FLYING BOAT HANDBOOK



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WASHINGTON  
GOVERNMENT PRINTING OFFICE  
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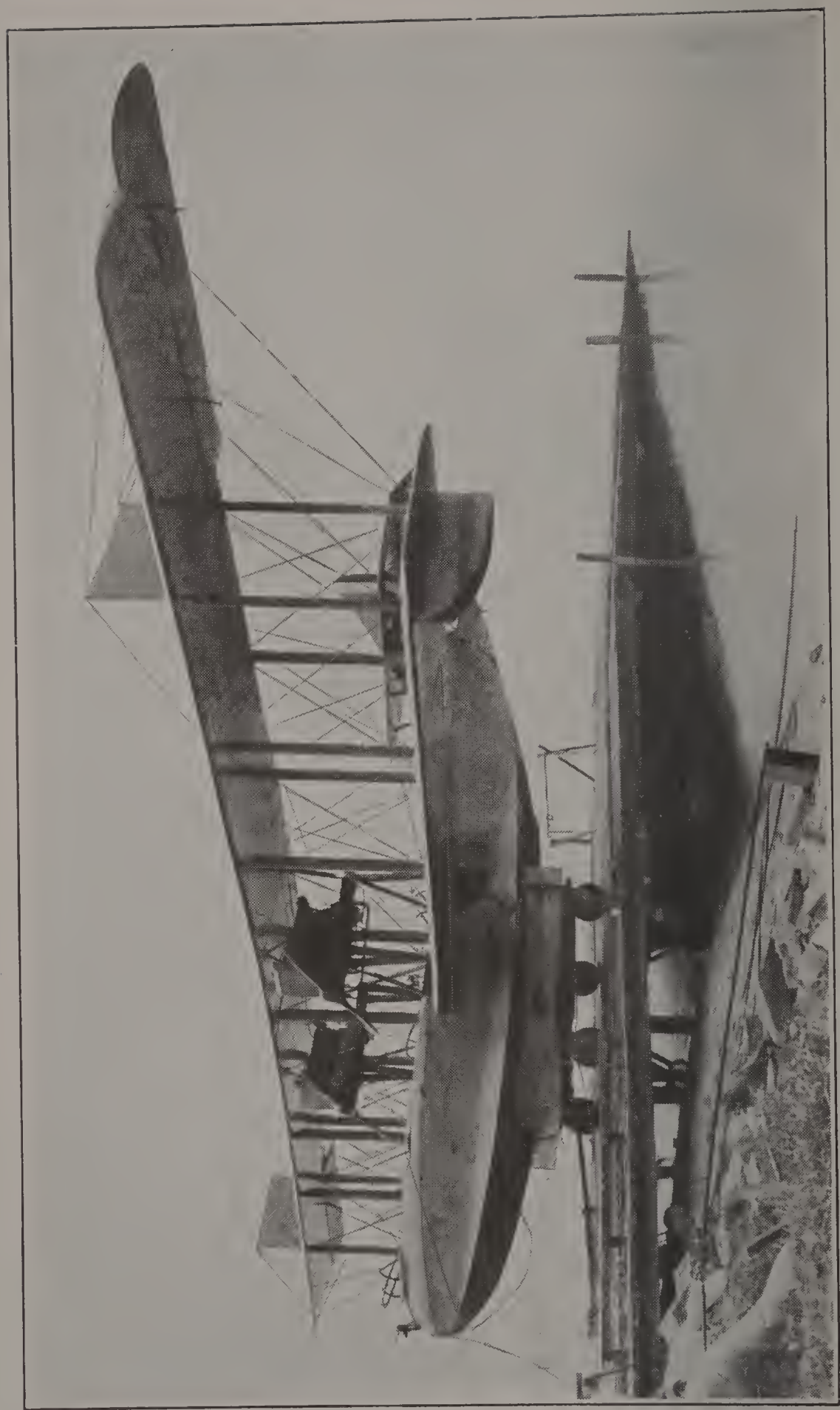


FIG. 1. COMPLETE ASSEMBLY.

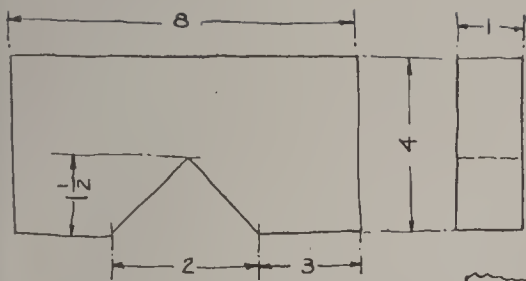


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DETAIL OF BLOCK "A"

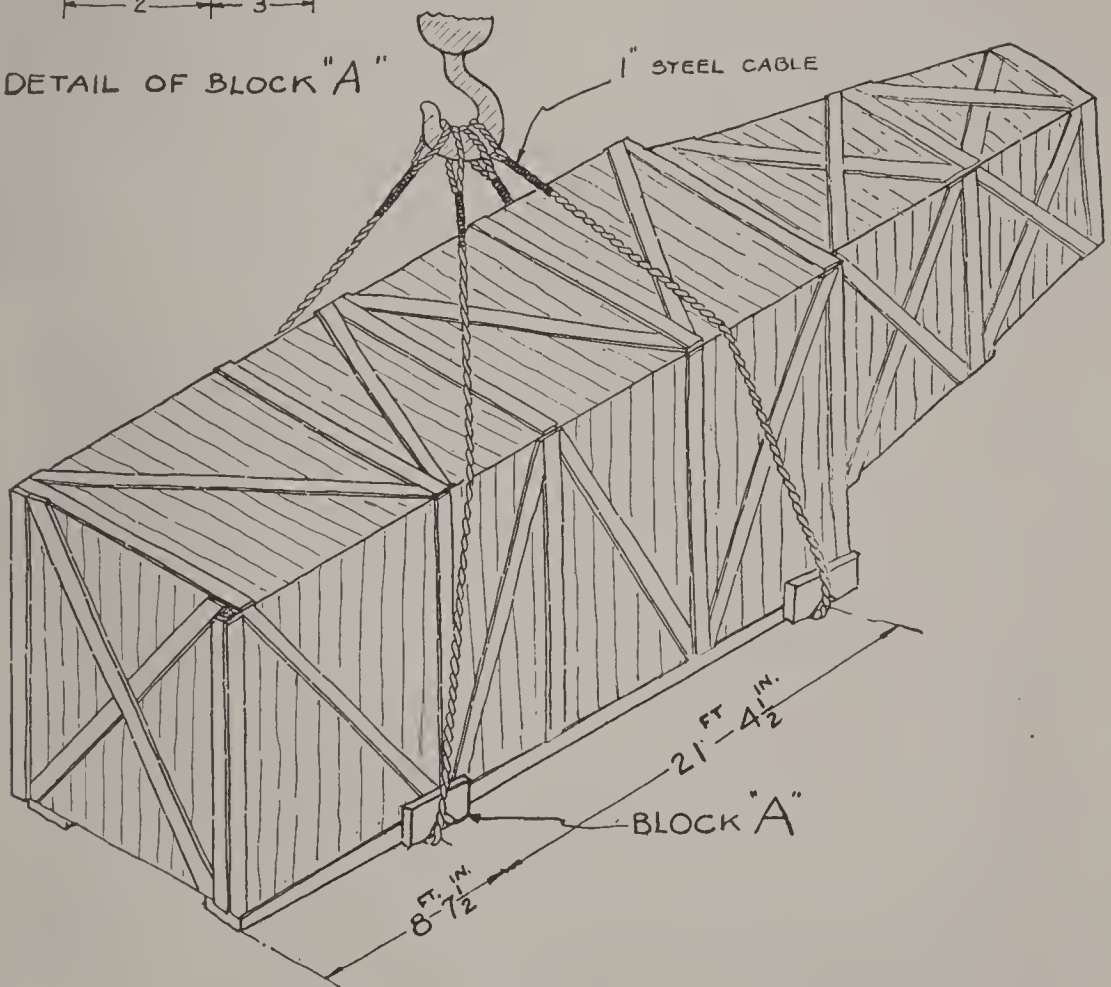


FIG. 2.—METHOD OF LIFTING HULL CASE.

Note.—Each sling is made of 1" by 66' AA strand cable.

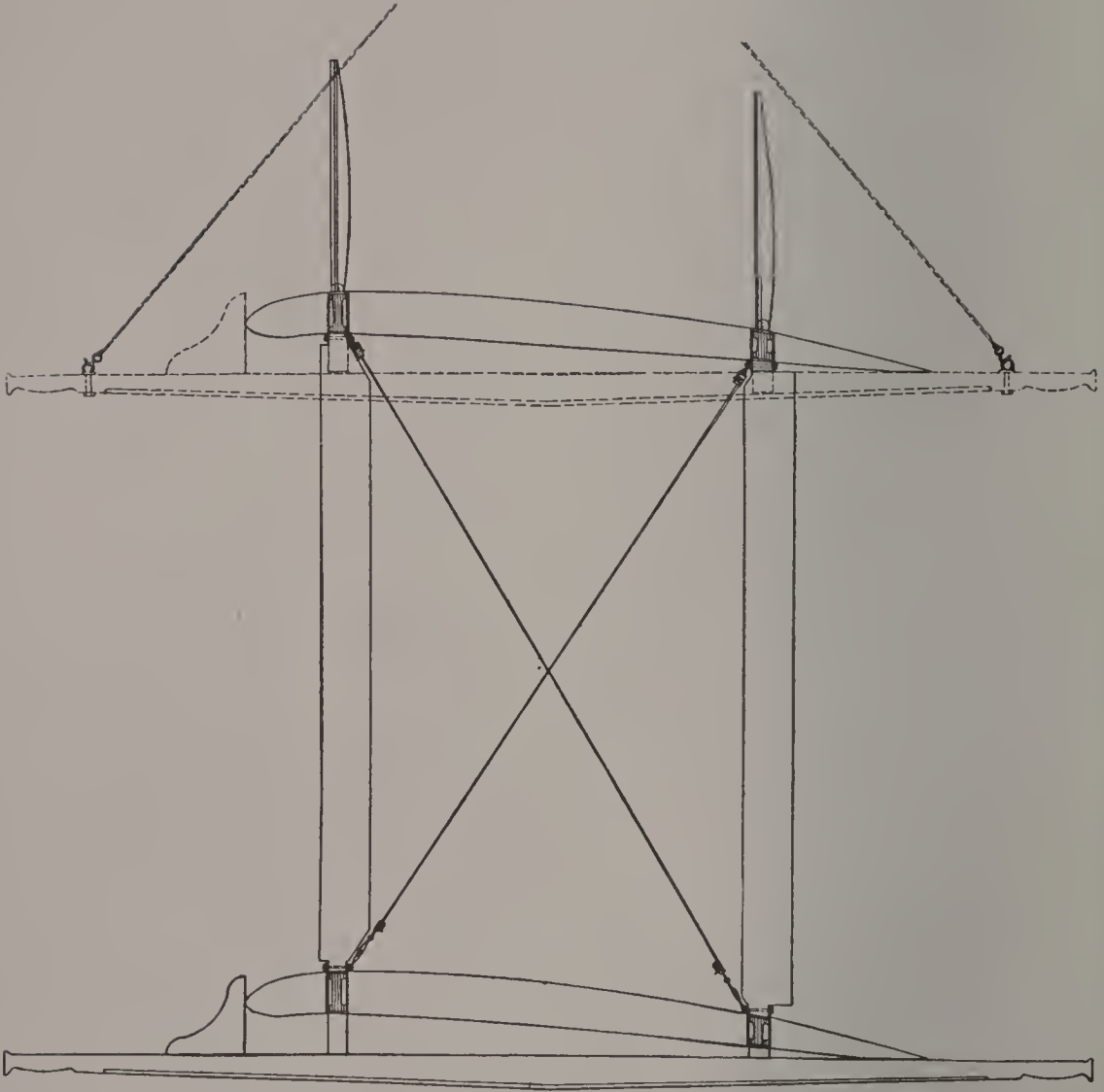


FIG. 3.—JIG FOR LIFTING PANELS.

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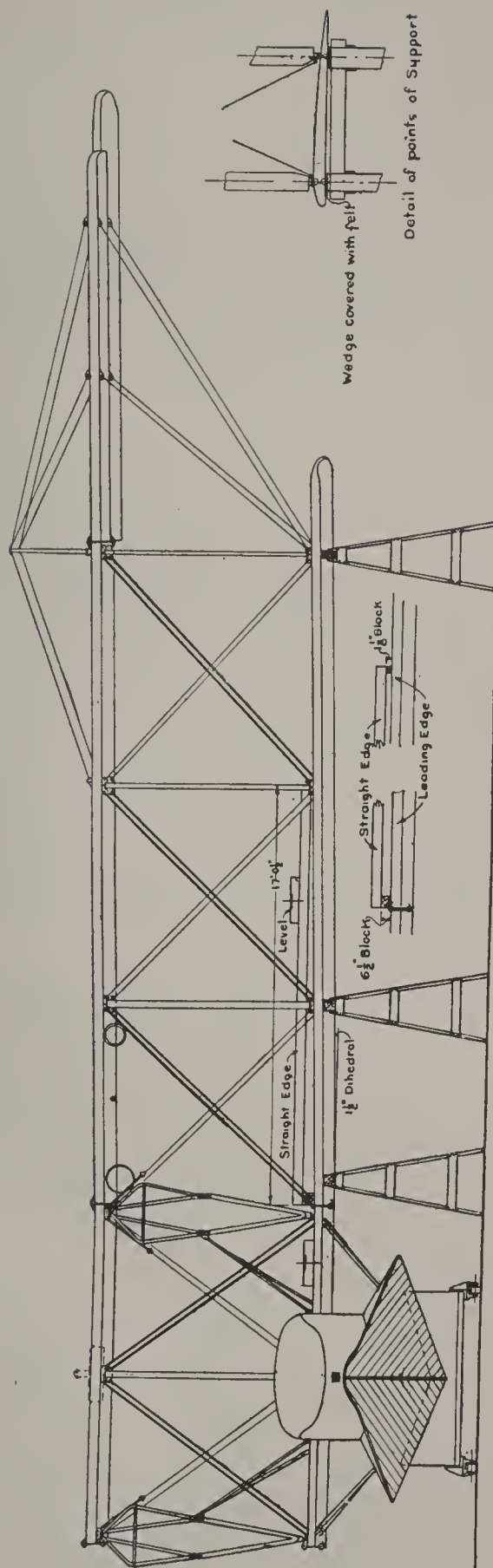
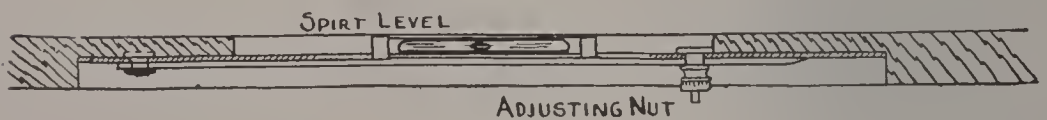
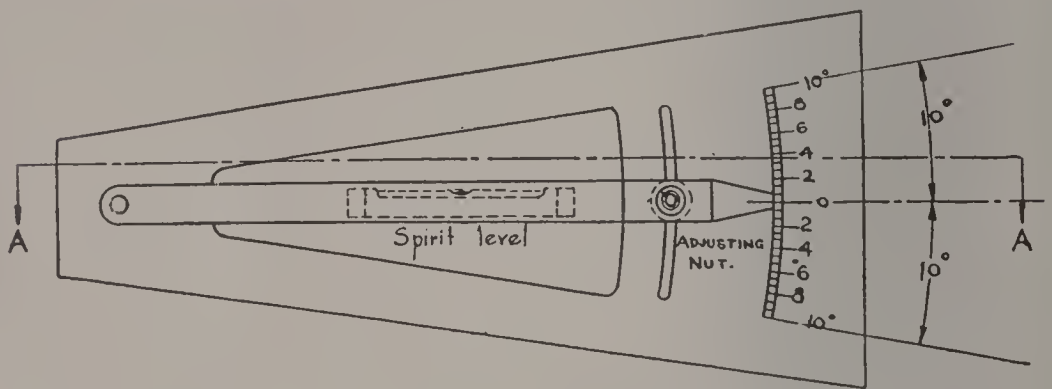
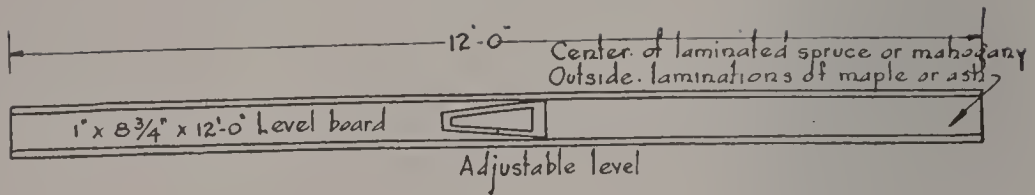


FIG. 4.—METHOD OF PANEL ERECTION.





SECTION AT A-A

FIG. 5.—ADJUSTABLE LEVEL FOR DIHEDRAL ANGLE.

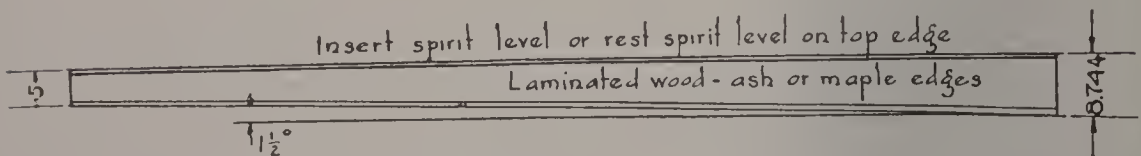


FIG. 6.—BEVEL BOARD FOR DIHEDRAL ANGLE.

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# **PART I**

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## **SPECIFICATIONS**

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# F-5L FLYING BOAT HANDBOOK.

## SPECIFICATIONS.

### 1. GENERAL DIMENSIONS.

Overall upper wing.....	103 feet 9 $\frac{1}{4}$ inches.
Overall lower wing.....	74 feet 3 $\frac{7}{8}$ inches.
Chord.....	8 feet.
Gap (C. L. of beams).....	8 feet 10 $\frac{1}{2}$ inches.
Stagger of wings.....	0°.
Sweepback of wings.....	0°.
Dihedral angle.....	1° 30'.
Angle of incidence, horizontal stabilizer.....	2° 30'.
Angle of incidence, wings.....	4° 0'.
Overall length of boat.....	49 feet 3 $\frac{11}{16}$ inches.
Overall height of boat.....	18 feet 9 $\frac{1}{4}$ inches.
Wing curve.....	Modified R. A. F. 6.

### 2. AREAS.

	Square feet.
Wing surfaces.....	1, 278. 0
Ailerons.....	119. 0
Total supporting surface.....	1, 397. 0
Horizontal stabilizer.....	120. 9
Vertical stabilizer.....	34. 7
Rudder.....	33. 5
Elevators (2).....	55. 3
Nonskid fins (2).....	31. 1

### 3. MOTORS.

Two Liberty 45° Vee, 4-cycle, 12-cylinder	
.....horsepower per motor (rated)....	330

## 4. TANK CAPACITIES.

	Pounds.
Gasoline, 495 gallons, at 6.25 pounds per gallon . . . . .	3, 094
Oil, 34 gallons, at 7.5 pounds per gallon . . . . .	255

## 5. ENDURANCE.

	Hours.
Full speed (64 gallons gasoline consumption per hour) . . . . .	7 $\frac{3}{4}$
Cruising speed (44 gallons gasoline consumption per hour) . . . . .	11 $\frac{1}{4}$

## 6. WEIGHTS.

## WING STRUCTURE.

	Pounds.
Top planes . . . . .	442
Extensions . . . . .	235
Center panels . . . . .	127
Lower panels . . . . .	538
Vertical stabilizer . . . . .	54
Horizontal stabilizer . . . . .	99
Ailerons . . . . .	133
Nonskid fins . . . . .	20
Rudder . . . . .	41
Tail stays . . . . .	67
Elevators . . . . .	60
Wing floats . . . . .	102
Wing fittings and bolts . . . . .	154
Struts . . . . .	279
Wires . . . . .	262
Total wing structure . . . . .	2, 613

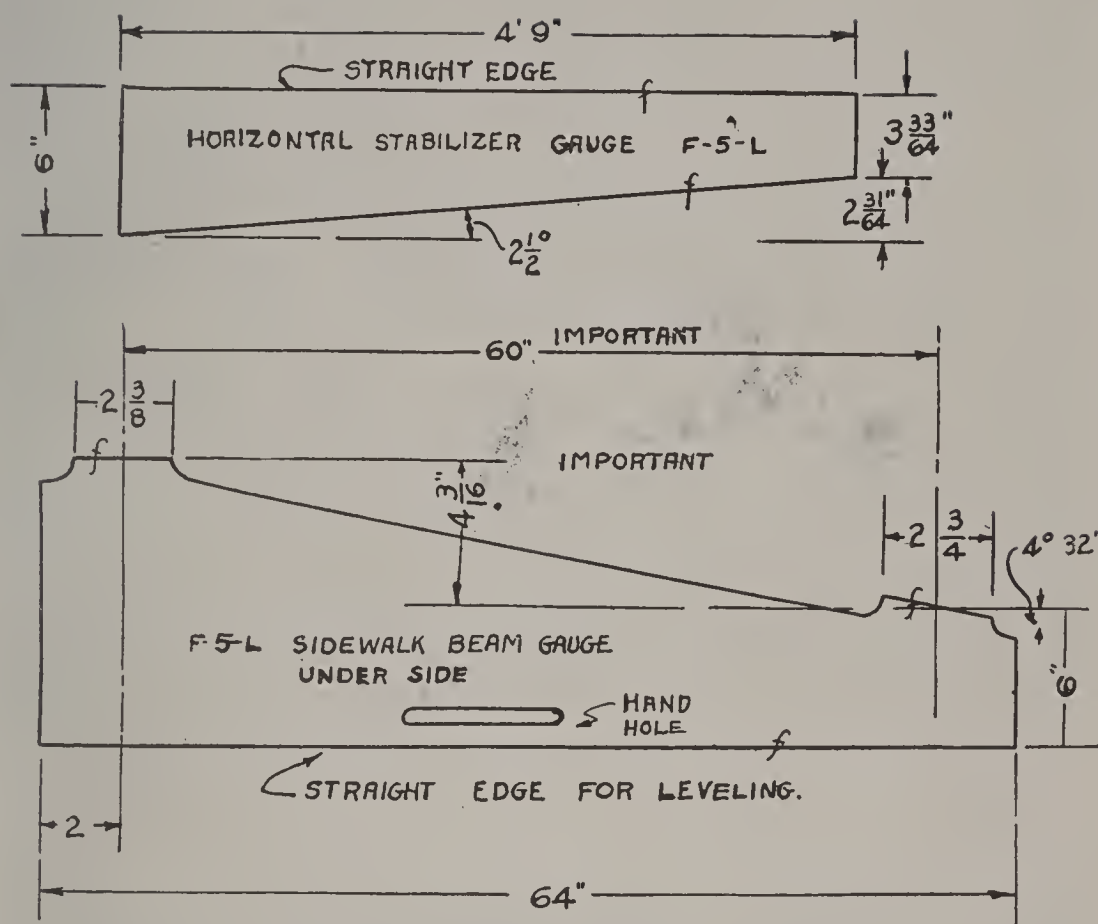
## HULL.

## Shell:

Sides and fin decking . . . . .	166
Planking . . . . .	369
Steps . . . . .	105
Hood . . . . .	121
Fabric . . . . .	11
Sundries . . . . .	146
Shell total . . . . .	918

## Skeleton:

Longerons . . . . .	138
Keel . . . . .	47



Make of  $\frac{3}{4}$ " 11-PLY VENEER or EQUIVALENT  
NON-WARPING MATERIAL

FIG. 7.—JIGS OF LEVELING AND ASSEMBLY.

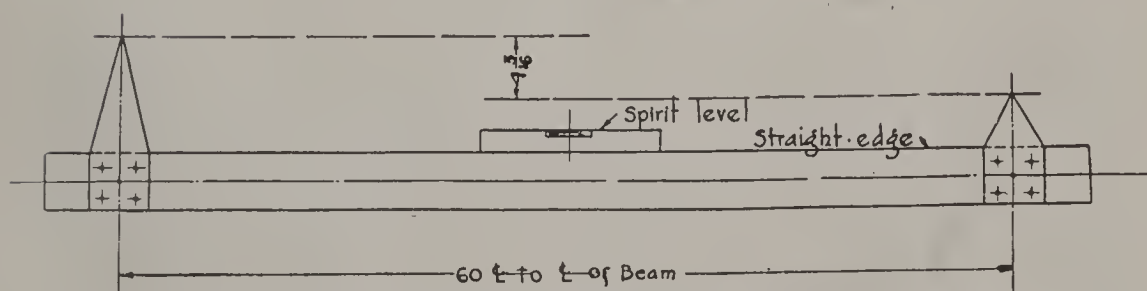


FIG. 8.—JIG FOR LONGITUDINAL ALIGNMENT OF HULL.



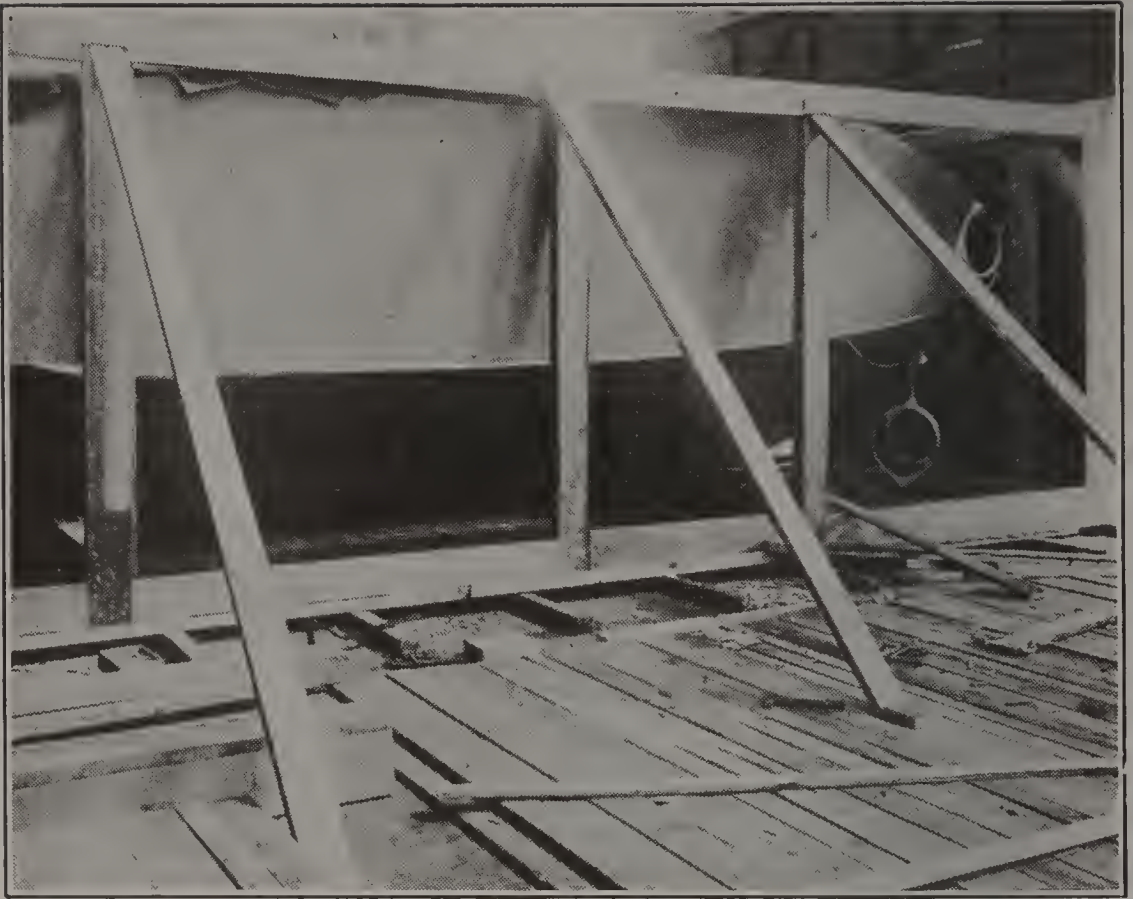


FIG. 18.—METHOD OF BRACING REAR OF HULL CASE BEFORE REMOVING EITHER SIDE OR TOP. THE WEIGHT OF THE HULL IS AGAINST THIS SIDE.

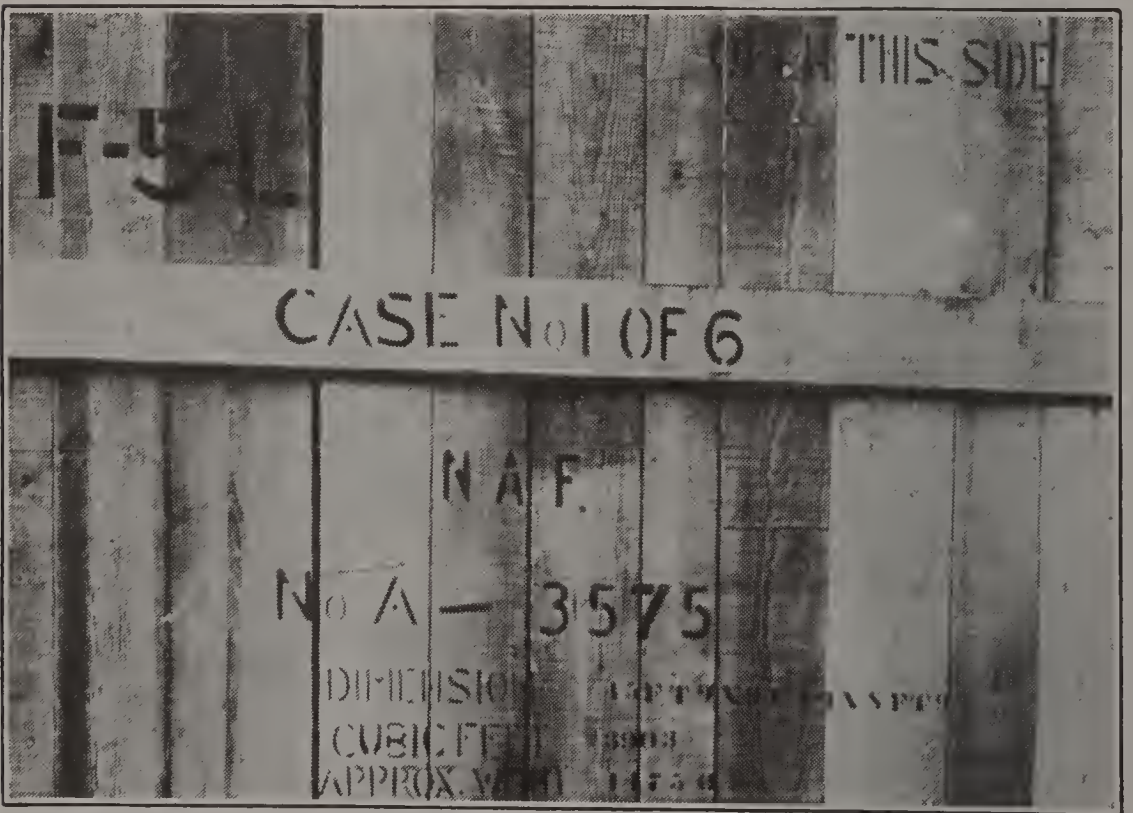


FIG. 19.—STENCILING ON SIDE OF HULL CASE.



Skeleton—Continued.	Pounds.
Keelson.....	51
Sternpost.....	5
Bracing.....	63
Stringers.....	71
Floors.....	97
Fin timbers and bottom ribs.....	89
Metal fittings.....	89
Stanchions.....	132
Total skeleton weight.....	<u>782</u>

Interior hull accessories:

Seats.....	42
Hand controls.....	61
Foot controls.....	25
Control wiring.....	49
Flooring.....	66
Bulkheads.....	101
Center bracing (wood).....	28
Spars.....	62
Compression tubes.....	14
Ribs—ends and covering.....	82
Fittings, etc.....	45
Total accessories.....	<u>575</u>

*Summary of hull weights.*

Shell.....	918
Skeleton.....	782
Interior hull accessories.....	575
Contingency.....	56
Total hull.....	<u>2,331</u>

STEAM ENGINEERING WEIGHTS.

2 motors, at 882 pounds each.....	1,764
2 radiators, at 79 pounds each.....	158
Radiator braces.....	6
Mountings.....	258
Water.....	226
Water piping.....	16

	Pounds.
2 propellers, at 68 pounds each.....	136
2 windmill gas pumps.....	14
1 hand gas pump.....	6
5 gasoline tanks.....	226
1 gravity tank.....	44
Piping.....	35
2 tachometers and shafting.....	22
2 oil-pressure gauges with piping.....	7
2 water thermometers.....	2
4 oil tanks with piping.....	81
4 gasoline gauges.....	7
Liberty tool kit.....	31
2 oil thermometers.....	3
2 hand cranks with gear.....	39
Motor controls.....	21
Ignition wiring.....	10
Contingency.....	120
Total.....	3, 232

## ORDNANCE EQUIPMENT.

1 Very pistol and ammunition.....	15
1 Lewis gun.....	18
1 shell deflector.....	2
2 Lewis magazines.....	20
1 Scarff ring gun mount.....	25
1 pilot directing bomb sight.....	21
4 bombs, at 230 pounds each.....	920
Bomb gear.....	125
Installation.....	44
Total.....	1, 190

## ELECTRICAL EQUIPMENT.

Electric lights.....	12
Switchboard.....	5
Wiring and installation.....	22
Telephone set.....	7
Range lights.....	10
Signal.....	8
Total.....	64

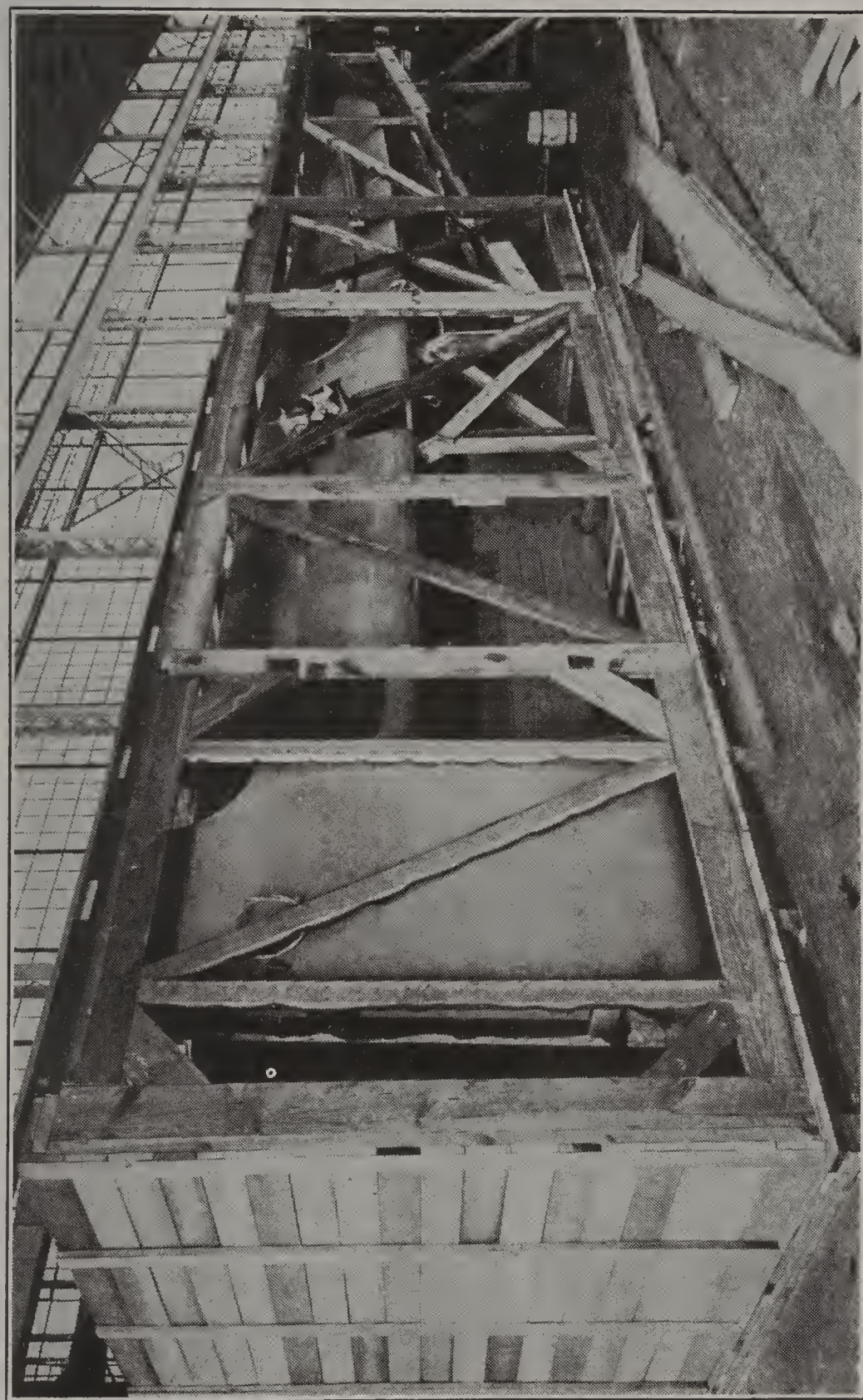


FIG. 20.—HULL IN CASE READY TO BE BOARDED UP.



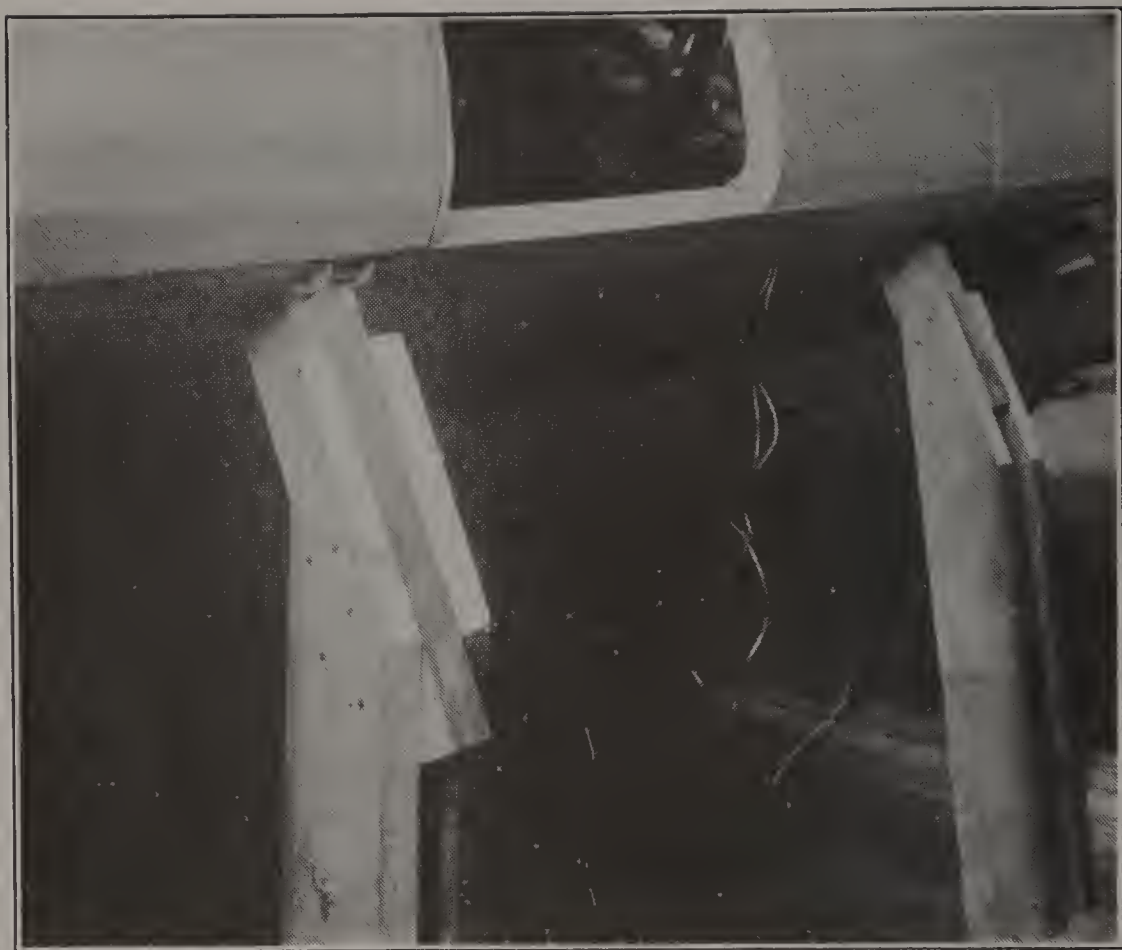


FIG. 21.—METHOD OF BRACING HULL IN CASE. BRACES ARE 2" BY 6" PIECES FASTENED TO DUMMY SIDEWALK BEAMS.



FIG. 22.—PORT FIN EDGE RESTING IN ITS GROOVE CUT IN THE CROSS TIMBER OF THE CASE.

## CONSTRUCTION AND REPAIR EQUIPMENT.

	Pounds.
1 sea anchor.....	15
1 bilge pump.....	14
1 air-speed meter.....	11
1 inclinometer.....	1
7 Pyrene fire extinguishers with brackets.....	46
1 bucket.....	5
Radio mast (installed).....	15
Total.....	<u>107</u>

## NAVIGATION EQUIPMENT.

2 compasses.....	6
1 clock.....	2
1 altimeter.....	1
Pigeons.....	5
Food and water.....	30
Chart board.....	4
Total.....	<u>48</u>

## MEDICINE AND SURGERY.

Medical kit.....	<u>10</u>
------------------	-----------

## RADIO.

Complete set S. E. 1100, including battery to operate all lights, etc.....	<u>260</u>
--	------------

## GASOLINE AND OIL.

Full oil, 34 gallons, at 7.5 pounds per gallon.....	255
Gasoline, 348 gallons, at 6.25 pounds per gallon.....	2,170
	<u>2,425</u>

## CREW.

4 mer., at 180 pounds each.....	<u>720</u>
---------------------------------	------------

*Summary.*

	Pounds.
Wing structure.....	2, 613
Hull.....	2, 331
Steam Engineering equipment.....	3, 232
Electrical equipment.....	64
Construction and Repair equipment.....	107
Navigation equipment.....	48
Medicine and Surgery equipment.....	10
Radio equipment.....	260
Ordnance equipment.....	1, 190
Crew—4 men.....	720
Gasoline and oil.....	2, 425
Total.....	<hr/> 13, 000





FIG. 23.—HULL FIN EDGE RESTING IN NOTCHED CROSS TIMBER OF CASE FRAME HULL BOX IS NOW BUILT AROUND HULL.



FIG. 24.—THREE-QUARTER VIEW OF HULL.





FIG. 25.—TYPE OF SLIPKNOT USED TO SECURE LIFTING ROPES TO SIDEWALK BEAMS. NOTE PADDING UNDER ROPE TO PROTECT BEAM FROM CUTTING.

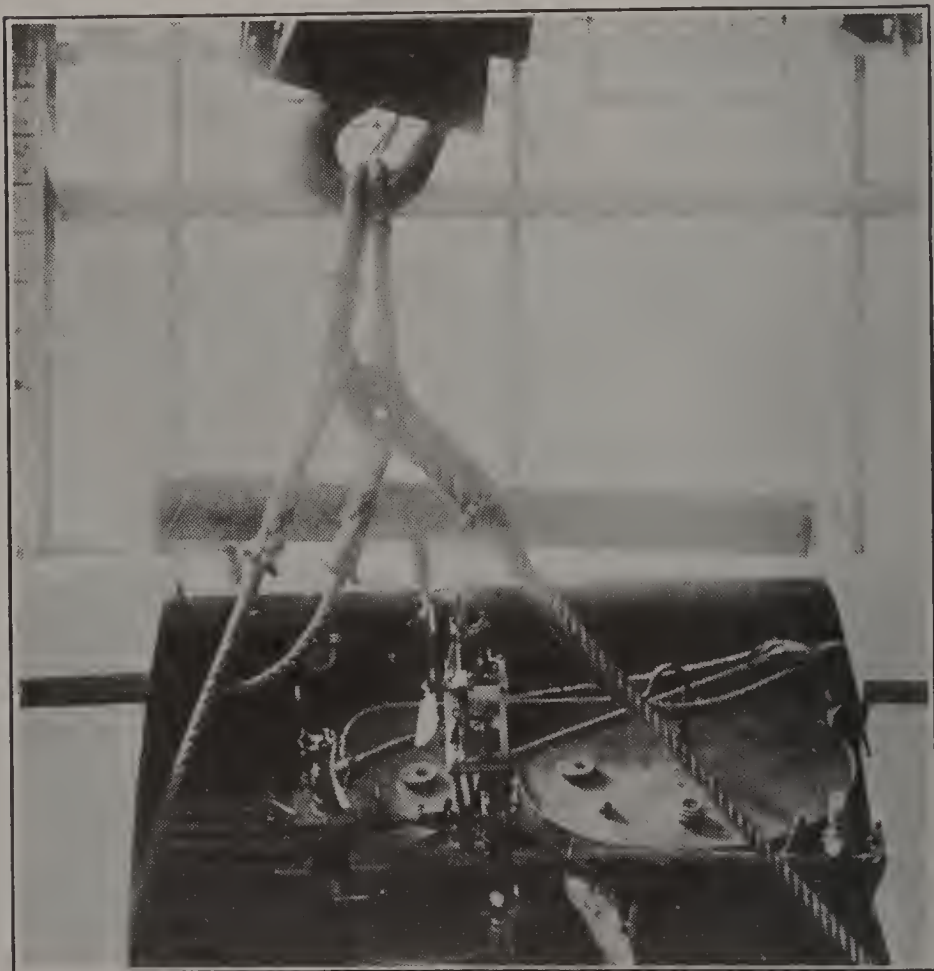


FIG. 26.—SLING ATTACHED TO REAR ENDS OF DUMMY BEAMS IS SECURED TO A TACKLE BLOCK SO THAT HULL MAY BE TILTED TO PROPER POSITION FOR LOWERING IT INTO CASE. SAME METHOD SHOULD BE EMPLOYED FOR LIFTING IT OUT OF THE CASE. BRACE BETWEEN BEAMS PREVENTS THEM FROM BENDING OUT OF ALIGNMENT.

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## PART II

---

### INSTRUCTIONS FOR ASSEMBLING

---



# **F-5L FLYING BOAT HANDBOOK.**

## **INSTRUCTIONS FOR ASSEMBLING.**

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### **1. Shipment.**

A complete boat is packed in eight separate boxes.

Box No. 1 contains the hull and instruments.

Box No. 2 contains the engine foundations, radiators and oil tanks.

Box No. 3 contains the main panels.

Box No. 4 contains the tail units and gravity gasoline tank.

Box No. 5 contains the wing floats.

Box No. 6 contains the propellers.

Boxes Nos. 7 and 8 contain the port and starboard motors.

### **2. Handling Boxes.**

The hull case must be handled with great care to keep it in perfect balance. At a point 8 feet from the nose end is a notched block; at the end opposite the nose end is another such block. These are notched to allow a 1 inch cable to rest in them. Two slings should be made, each from a piece of cable about 65 feet in length, these being ample to pass around the case, resting in the notched block and meeting a common tackle block at the top. (See fig. 2.) This will insure a balance when lifted. The top of each sling should have an eye spliced in the cable. The panel and engine boxes may be handled with

any ordinary hoisting equipment and those marked "Top" should remain in proper position.

### 3. Opening Boxes and Unpacking.

1. Box No. 1 is the large case containing the hull. One side is marked "Open this side." The roof is first removed and then the marked side. Take out all blocks and braces and also remove the tail housing. (See fig. 16.) The tail is in no way attached to the case and is easily uncovered. It is important that suitable bracing be placed at the side of the case which has not been removed, as all the side thrust of the weight of hull is against this side. This bracing must be placed before the top is removed.

2. The fuselage covers should be removed before rigging is placed. Care should be taken not to cramp the fin edge when lifting the hull. Sliding or shifting the hull laterally must be avoided.

3. The sidewalk beams are false, being only installed for transit. To these, ropes (at least 1 inch in diameter) are fastened. (See fig. 24.) A second sling is secured to the ends of the two beams against the back side of the case and this sling is attached to the center tackle.

4. Propellers are packed in a separate box. The top is fastened by screws. Remove all screws and also the nut in the center of lid. The propellers are held in place only by the center bolt and are readily lifted out.

### 4. Examination of Parts.

The shipment is made up with a view of compactness, and the cases do not necessarily contain complete individual units. In each box there is a list of all the parts therein. Each part should be carefully examined as it



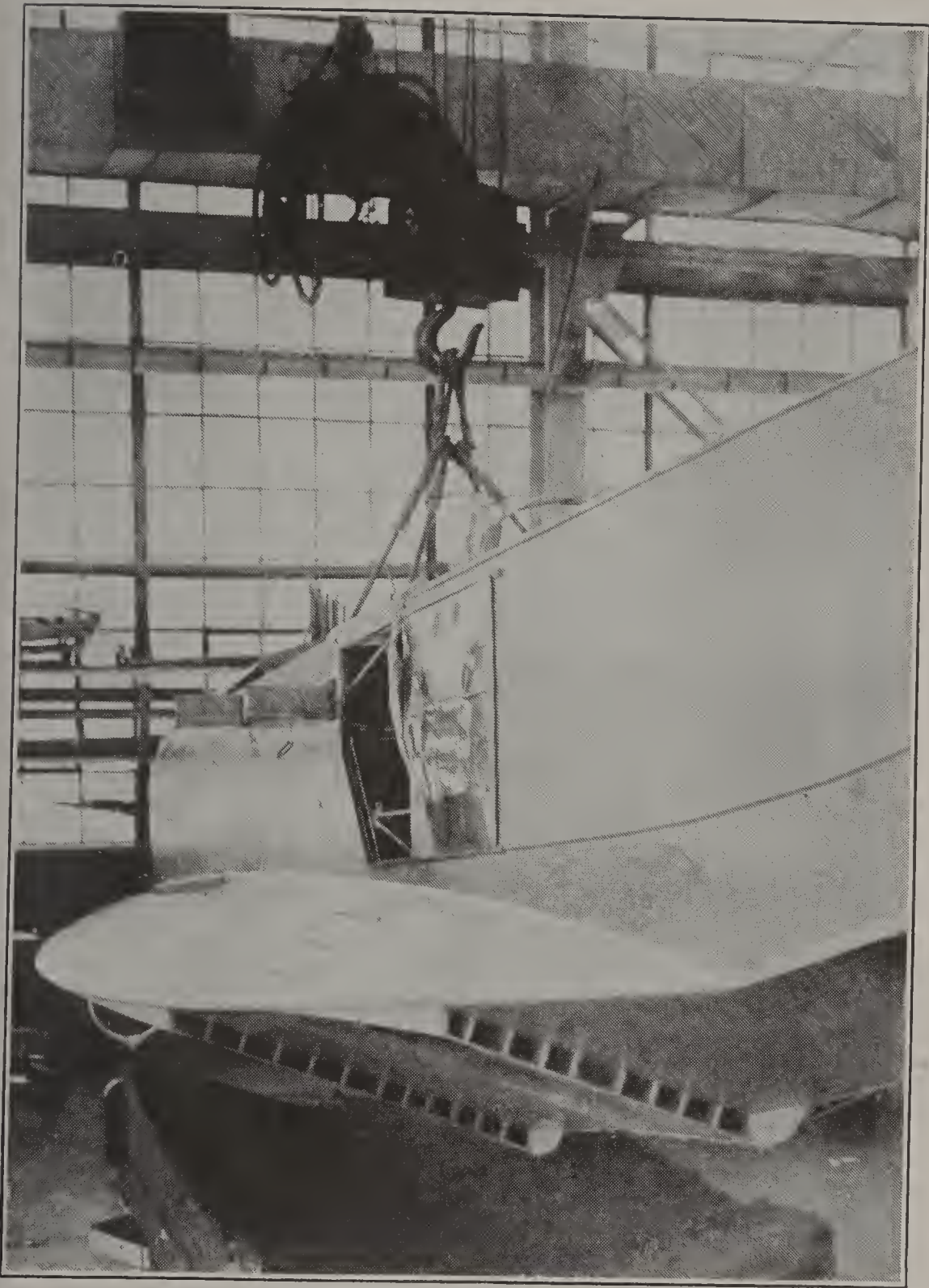


FIG. 27.—HULL BEING LIFTED BY A CRANE BLOCK, THE ONE AND ONE-HALF INCH ROPES BEING SECURED TO SIDEWALK BEAMS NEXT TO HULL SIDES.

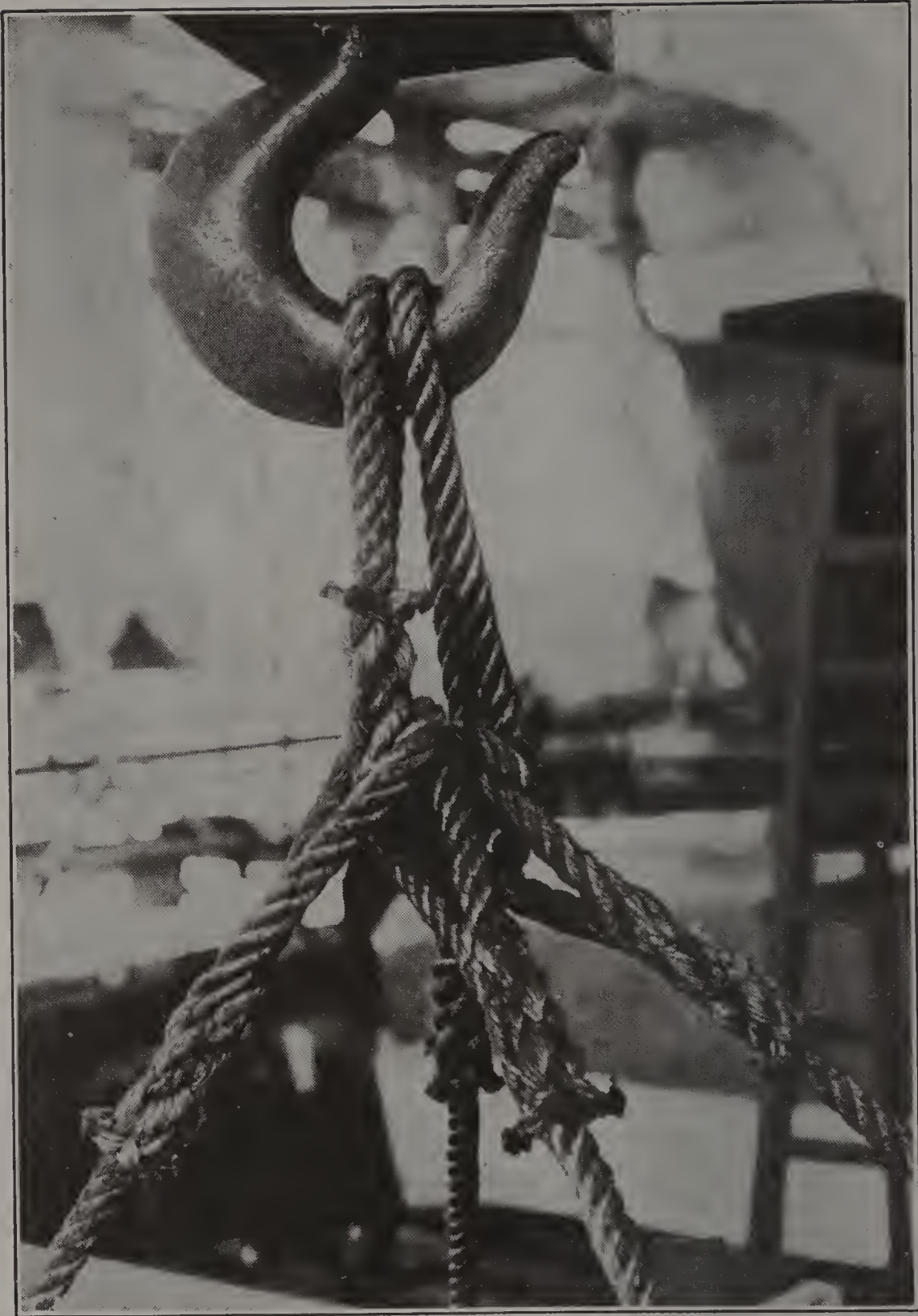


FIG. 28.—METHOD OF HOLDING THE FOUR ROPES FROM SIDE-WALK BEAMS TO CENTER LIFTING BLOCK.



is taken out of its respective box. Any defects should be carefully noted so as to be given proper attention and to avoid a possibility of being placed on machine. Although all parts are thoroughly inspected before being packed, they should be again gone over with particular attention to the following:

(a) HULL.

1. That alignment is correct and no wood members are broken. Inspect splices and wrappings.

2. That bolts are tight and properly cottered. Nuts, pins, and cotters, when removed during disassembling, are, whenever possible, put back in place. Examine threads before tightening nut. Do not force a nut over a burred thread.

3. That wires are taut, free from kinks, and that turnbuckles are safety wired.

4. That instruments are not damaged and wire connections are tight.

5. That all metal parts are fully covered to protect from corrosion.

6. That gas tank tie downs are secure, safety wired, and all lines tight. If a gas line connection is found loose, take apart, clean, and put together with a suitable sealer.

(b) PANELS AND TAIL.

7. That all surfaces are taut, free from breaks, dents and tears.

8. That no internal parts of panels are broken. It being impossible to inspect the interior structure by ordinary methods, this part of the work should be passed on by an experienced person.

9. That fittings are tight and properly secured.

## (c) GENERAL.

10. That all necessary units for completing the assembly are present, and that inclosed lists check with present contents of boxes.

**5. Assembly of Center Section.**

1. Place suitable spreader between upper starboard and port longerons to act as support until dummy beams have been removed and sidewalk panels attached.

2. Remove dummy sidewalk beams. Enter sidewalk panel beams through sleeve fittings, and place bolts in center line and hull side fittings. Remove spreader.

3. Diagonal braces are strung through fin, bolted to fitting at underside of sidewalk panels, and bolted to fitting on lower longeron.

4. Be sure that all nuts are thoroughly secured by lock washers.

5. The spot selected for placing cradle should be comparatively level. Two methods of adjusting the cradle may be employed: (a) placing a screw jack under each corner, or (b) using taper wedges which may be driven under cradle.

6. Boat must be leveled both laterally and longitudinally. Level the boat laterally by placing straightedge and spirit level across boat on both front and rear beams, and jacking up cradle accordingly. Proper leveling fore and aft must be taken with respect to the four (4) degree angle of attack, measured on underside of sidewalk panels, parallel to center line of hull. A convenient method of doing this work is to make a jig as illustrated in figure 7, which has two fixed vertical points so arranged that when proper angle of incidence is attained bottom of jig will be level. A spirit level may either be incor-

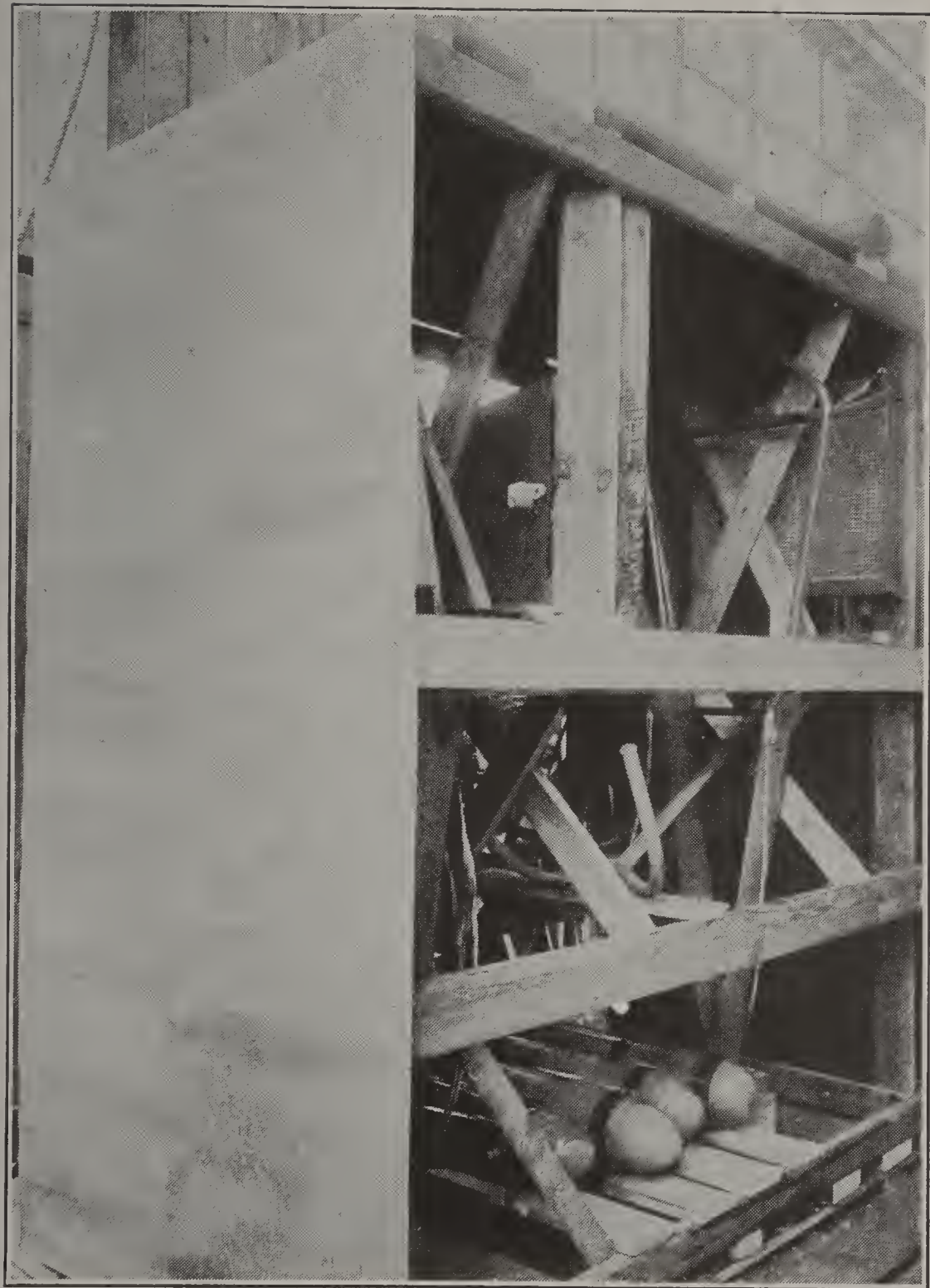


FIG. 29.—PACKING CASE SHOWING ENGINE FOUNDATIONS, RADIATORS, OIL TANKS, AND WATER PIPE MANIFOLDS ATTACHED. THIS CASE SHOULD BE KEPT RIGHT SIDE UP, AND IS SO MARKED.



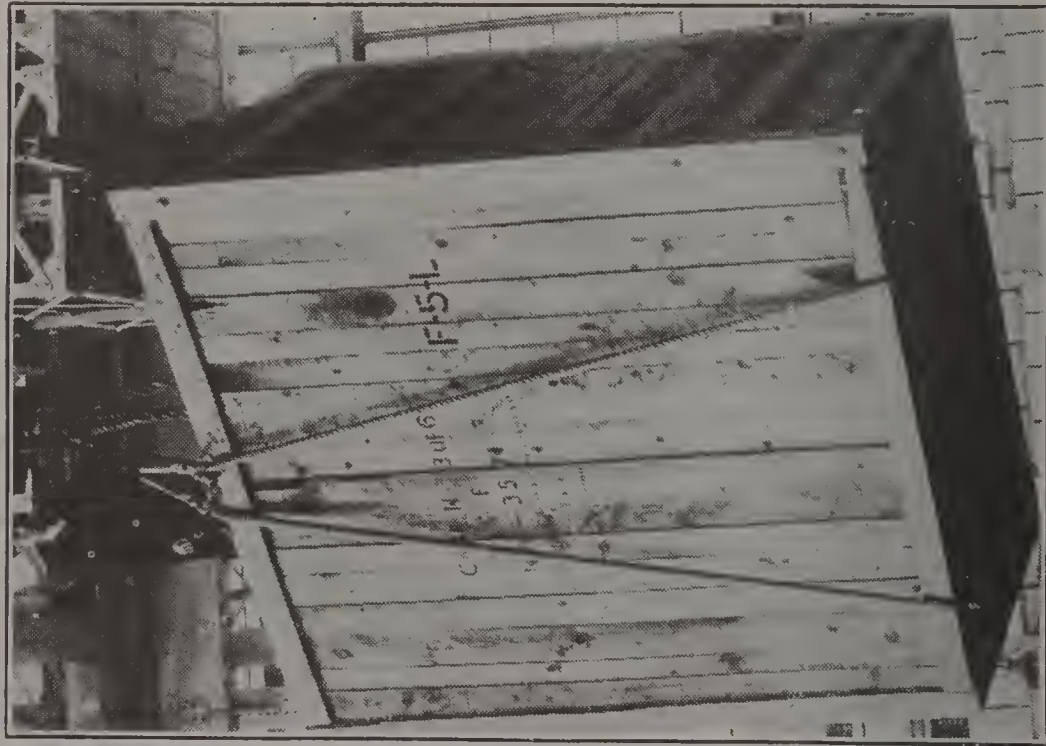


FIG. 30.—METHOD OF LIFTING CASES, SHOWING SLINGS PLACED TO INSURE A BALANCE. ONE AND ONE-HALF INCH



FIG. 31.—METHOD OF LIFTING PANELS OUT OF BOX. NOTE THAT SLING IS PLACED AROUND PANEL AND SECURED TO

porated in, or used in conjunction with, the jig itself. Care should be exercised, however, that points of jig be placed at all times on center lines of the beams. Should boat be moved at any time during process of leveling, it should be rechecked for level. Figure 8 shows a jig for longitudinal alignment of hull.

7. Install two engine section struts at center of boat.

8. If engines are detached from mountings, they should next be installed in same. Radiators may also be mounted and water connections secured.

9. Sufficient supports should now be placed under sidewalk beams at hinge points, until engines and wings are attached and properly braced by wires. This will eliminate warping of sidewalk panels due to excessive weight. Lift engine mounting (with engine) by means of crane or chain falls. If these are not available, motor mountings may be skidded into position by use of long planks, but, as this is difficult, it should not be attempted unless absolutely necessary. Connect up diagonal braces from engine mountings to fittings on center of sidewalk beams. Connect up all stays and wires and adjust these to a fair tension. Engine beds should be level both laterally and longitudinally when boat is level.

10. Connect all piping and electrical wiring to engine.

11. Raise engine section panel into place, attach struts and wires and connect up gasoline piping to gravity tank.

12. Check level of engine section panel by placing straightedge with spirit level along front and rear beams, or by measuring distance between upper and lower hinge both front and rear.

13. Check for zero (0) degree stagger by dropping plumb line over leading edge at both outer ends of upper engine section panel. Adjust stagger wires to bring

leading edge of upper panel directly over leading edge of sidewalk panels.

#### 6. Assembly of Outer Wing Panels.

1. Connect upper intermediate and upper outer panels at hinges (without ailerons). Stand upper and lower wing panels on their leading edge parallel to each other. Connect panels with struts and stay wires. Interplane struts are numbered as per diagram, figure 10. Tighten wires to approximately flying tension.

2. Attach nonskid fins and supporting wires, and see that top beam is in alignment and nonskid fins normal.

3. Do not tighten flying wires to overhang excessively or too much tension will be thrown on upper king-post brace wires.

4. Raise assembled panels, engage two hinges on lower panel and hinges on sidewalk, enter hinge pins, and then raise panel assembly at outer end and connect up the two upper hinges of intermediate panel with hinges on engine section panel. Support assembly until landing wires are fastened. (See fig. 4.) Unless panel assemblies on starboard and port sides are raised into place simultaneously, supports under one side must not be removed until opposite side has been assembled and wires fastened.

5. As an alternate method of erecting panels, connect upper intermediate and upper outer panels at hinge points, attach nonskid fins and upper brace wires to same. Raise this assembly into place by use of slings (fig. 3), which remain in place until erection is completed. Connect up interplane struts and brace wires at strut fittings of upper panel. Attach lower panel at sidewalk hinges and connect struts to wires. After wires are made



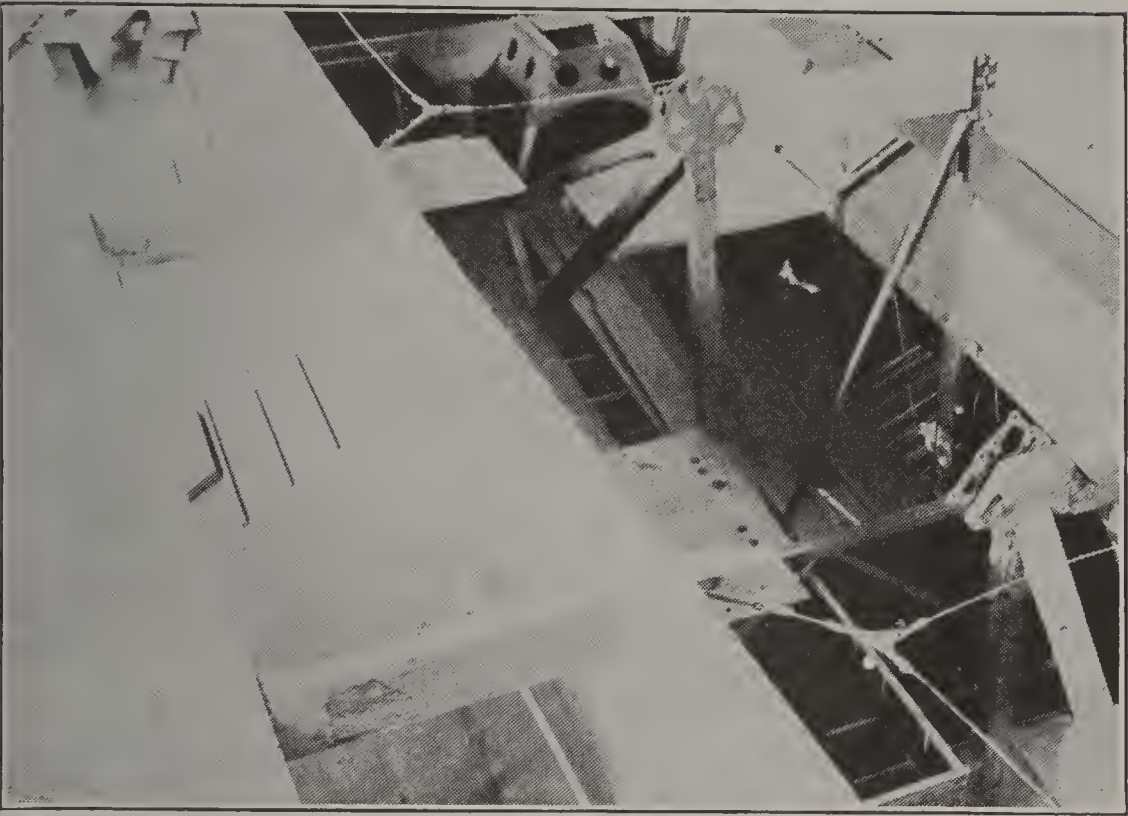


FIG. 32.—DETACHABLE SIDEWALK PANEL PARTLY REMOVED.  
LOOKING FORWARD.

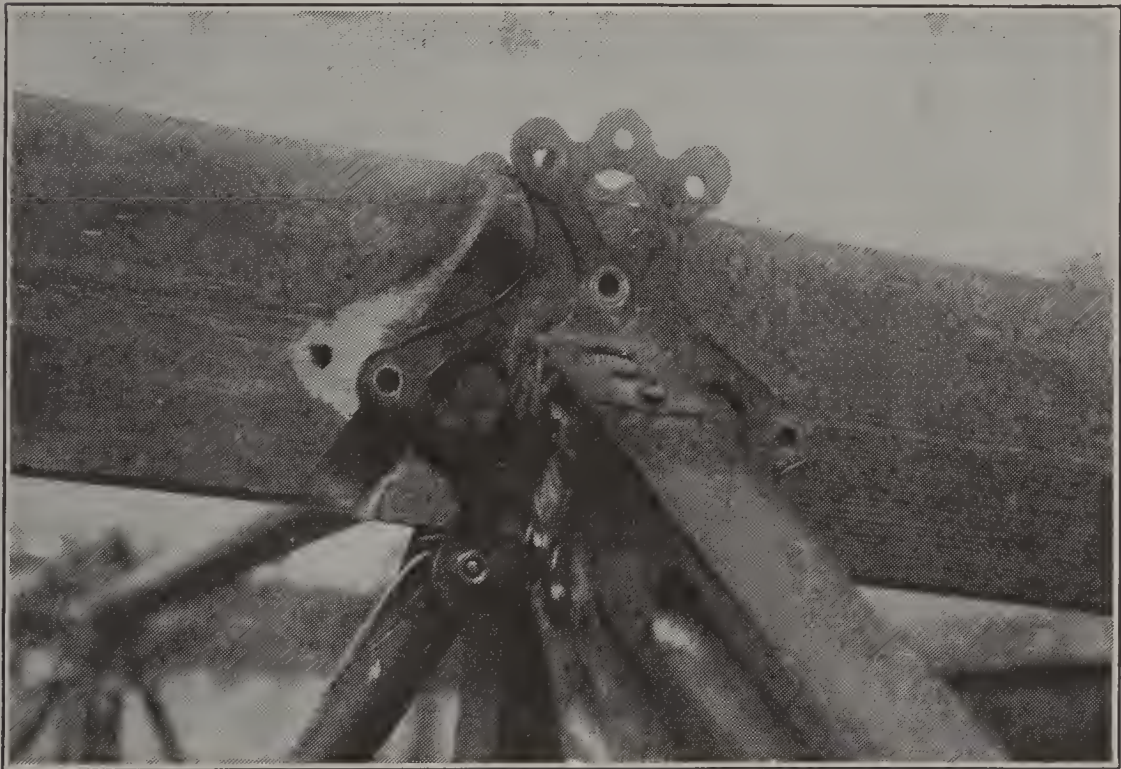


FIG. 33.—SPlice IN SIDEWALK BEAM WITH STARBOARD PIECE  
PARTLY REMOVED.



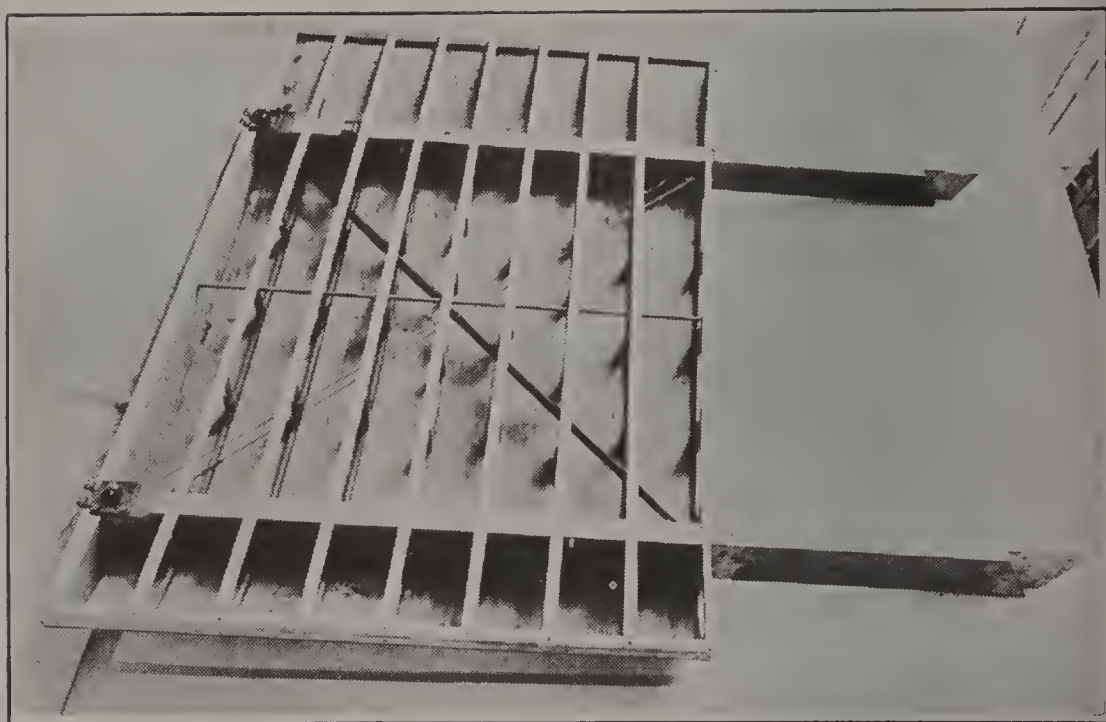


FIG. 34.—SIDEWALK PANEL REMOVED AFTER FITTING AND READY FOR UNDERSIDE COVERING. PORT PANEL TO BE MARKED "P" AND STARBOARD PANEL "S," WITH BOAT NUMBER FOLLOWING LETTER. TOP SURFACE OF THESE PANELS IS COVERED WITH VENEER.

fast, overhead slings can be removed. After erection by either first or second method, proceed as follows:

6. Attach ailerons and secure hinge pins. While this can be done on the ground it is advisable to assemble them after panel erection, owing to their size and weight.

7. Connect up all control wires to ailerons, adjusting lengths of wires to obtain a continuation of the lines of the panel.

8. Adjust landing wires so as to get proper alignment of wings and approximately correct tension. Tighten flying wires, giving these slightly less tension than landing wires.

9. Adjust stagger wires, giving each of these equal tension.

10. Sight along leading and trailing edges of upper and lower panels, from center, and see that edges are straight and parallel to each other, and that ailerons are in line with wings.

11. Check for zero (0) degree stagger by use of a series of plumb bobs dropped from leading edge of upper wings.

12. Angle of incidence of four (4) degrees can be checked with same gauge as used on sidewalks when leveling up boat. Check between beam centers at several points along wing, so as to detect any warp.

13. Dihedral angle of one and a half ( $1\frac{1}{2}$ ) degree can be determined by use of a long straightedge equipped with a protractor level or a straightedge planed to the required angle and using a spirit level on top edge. (See figs. 5 and 6.)

14. With struts in position and a zero (0) degree stagger, the angle of incidence of top plane can be checked by measuring the gap between upper and

lower leading edges and upper and lower trailing edges, providing the lower panel has been properly set at the required angle. Distance is 8 feet 10½ inches.

15. See that all control wires to ailerons have the same tension.

16. Attach pontoons to lower wing panel tips.

17. Fasten bomb-dropping devices, and see that U bolts are not set up tighter than necessary to secure them.

18. Check up length of drift wires from each side of nose to upper and lower wing panels. Have these wires of equal length and tension. This will square wings with axis of hull. Follow same procedure with brace wires from horizontal stabilizer to square stabilizer with hull.

19. Inspect all wires, clevises, cotter pins, turnbuckles, pipe lines, wiring, controls, tie-rods and connections throughout boat, and see that everything is taut and in proper shape. Place safety wires on all turnbuckles after their final adjustment. Turnbuckles should not show over three threads outside of barrel, or less than ¾ inch of shank when they are finally adjusted.

20. Attach propellers, guns, and all accessories.

### 7. Assembly of Tail Surfaces.

1. Tail surfaces can be assembled at any time after hull has been leveled.

2. Attach fin and check so that fin is exactly vertical when boat is level.

3. Set horizontal stabilizer over fin and fasten to fin by vertical tie-down bolt in front and by metal clip on rear.



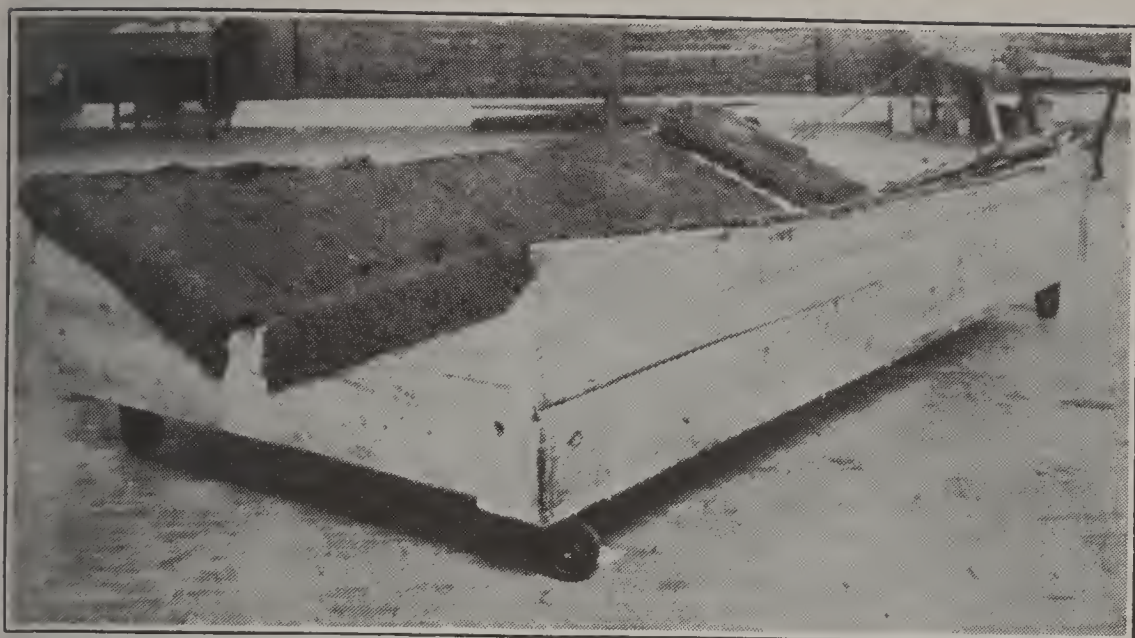


FIG. 35.—THREE-QUARTER VIEW OF CRADLE USED FOR HOLDING HULL DURING ASSEMBLY. BED IS SHAPED TO FIT HULL BOTTOM WITH STEP, AND PADDED WITH ONE-INCH SOFT FELT. CASTORS AT EACH CORNER FACILITATE SHIFTING OF HULL. USUAL METHODS OF LEVELING MAY BE EMPLOYED AFTER CRADLE IS PLACED IN POSITION.

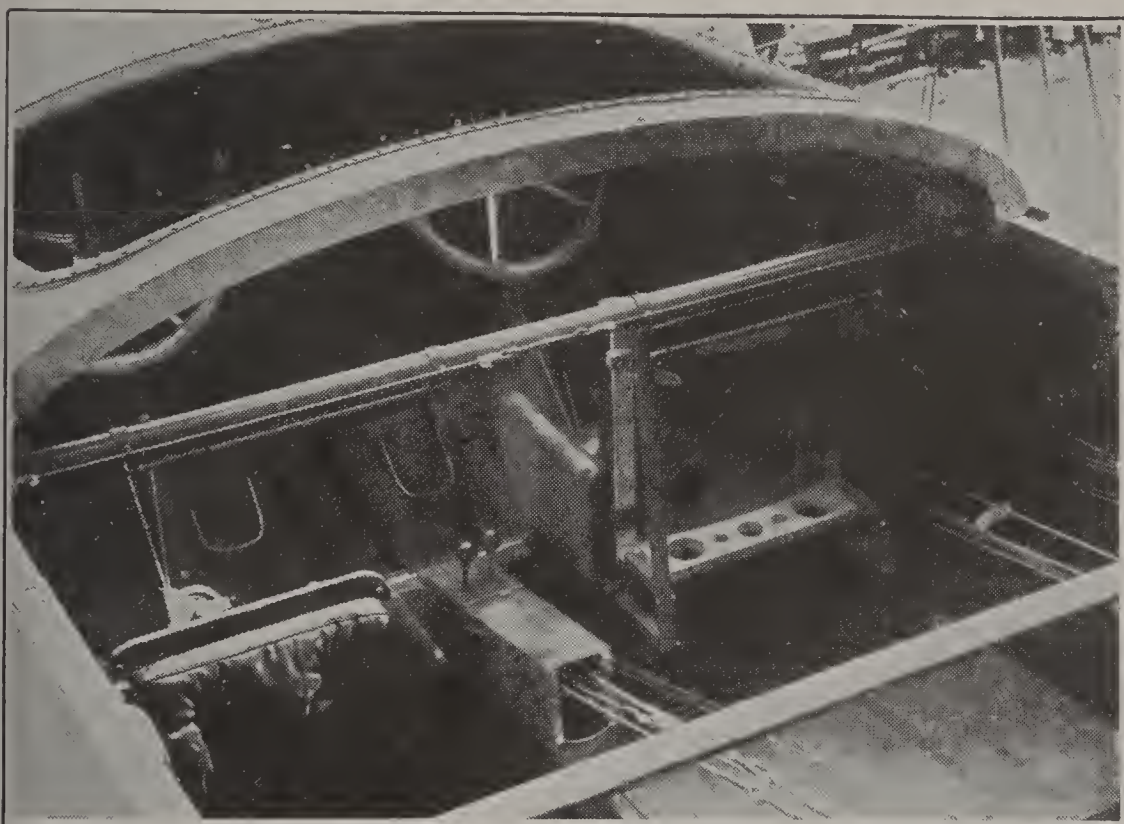


FIG. 36.—THROTTLE CONTROLS FOR MOTORS. NOTE DOWN POSITION OF PORT SEAT. STARBOARD SEAT IS STATIONARY.

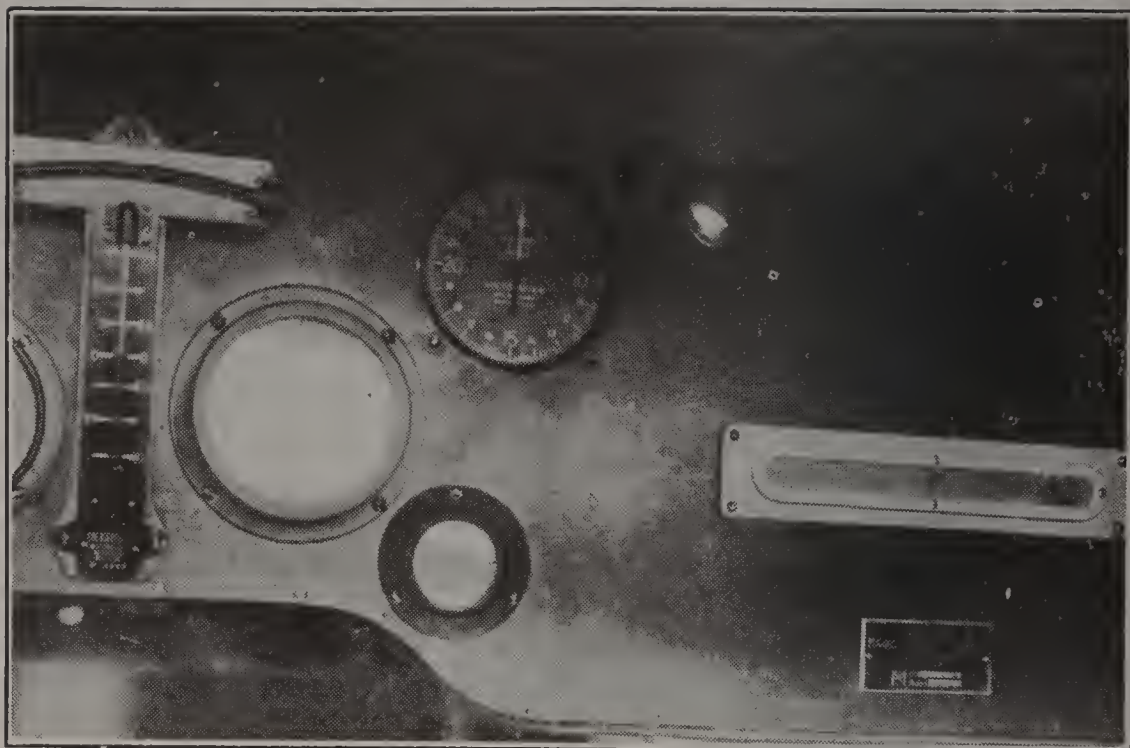


FIG. 37.—INSTRUMENT BOARD WITH NEW TYPE BOMB SIGNAL DISK AT RIGHT END.



FIG. 38.—RUDDER CONTROL LOOKING AFT.



4. Attach all forward steel stabilizer braces and outside rear braces, and set all stay wires. Stabilizer should be level laterally when hull is level.

5. Horizontal stabilizer is set with a two and one-half ( $2\frac{1}{2}$ ) degrees angle of incidence, and a straight line drawn through leading and trailing edges should be at an angle of two and one-half ( $2\frac{1}{2}$ ) degrees with engine beds. Check this angle by using jig (fig. 7) along top of stabilizer from front to rear beam, parallel to hull. Check this angle near fin and again at outer ends of stabilizer to see that there is no warp.

6. Attach rudder and secure hinge pins. Fasten rudder balance panel to rudder and connect up remaining two steel braces to stabilizer. Attach elevators at hinge points and secure with locking pins. Smaller horns are attached to underside of elevators. Stay wires from control horns on ailerons and elevators to trailing edges may be used to straighten out warp in these surfaces. Control wires on elevators should be adjusted so that when control column is in neutral position, elevators will be at the same angle of incidence as the horizontal stabilizer. Control wires should be allowed a little slack in their neutral position to avoid binding in extreme positions. Rudder-control wires should be fairly taut but should not cause binding on rudder pins.

## 8. General Information.

### PIPE LINES.

The fuel lines are shown in figure 15. They are all marked with a red band painted on each end so as to be easily distinguished from other piping.

The air lines, including vents from fuel tanks and air speed meter, are marked with a blue band.

The tube leading to the oil-pressure gauges on the instrument board is marked with a white band.

The water pipes are marked with a yellow band and compressed air or starter pipes are marked with black bands.

The brass tubing on both port and starboard side contains the bomb release control wires. These have no mark on them.

#### HAND PUMPS.

There are two hand pumps of similar construction, one for pumping fuel into the gravity tank for starting and emergency and the other for pumping bilge. These pumps are of the semi-rotary type and are easily taken apart for inspection and repair. The fuel pump is located on the after center stanchion, and the bilge pump aft of the forward center stanchion.

#### LUBRICATION.

Figures 11 and 12 show points on boat which require lubrication of grease and oil aside from motors. These charts show all ferrules and pulleys which will need attention to prevent undue wear and aid in easy control of the moving parts.



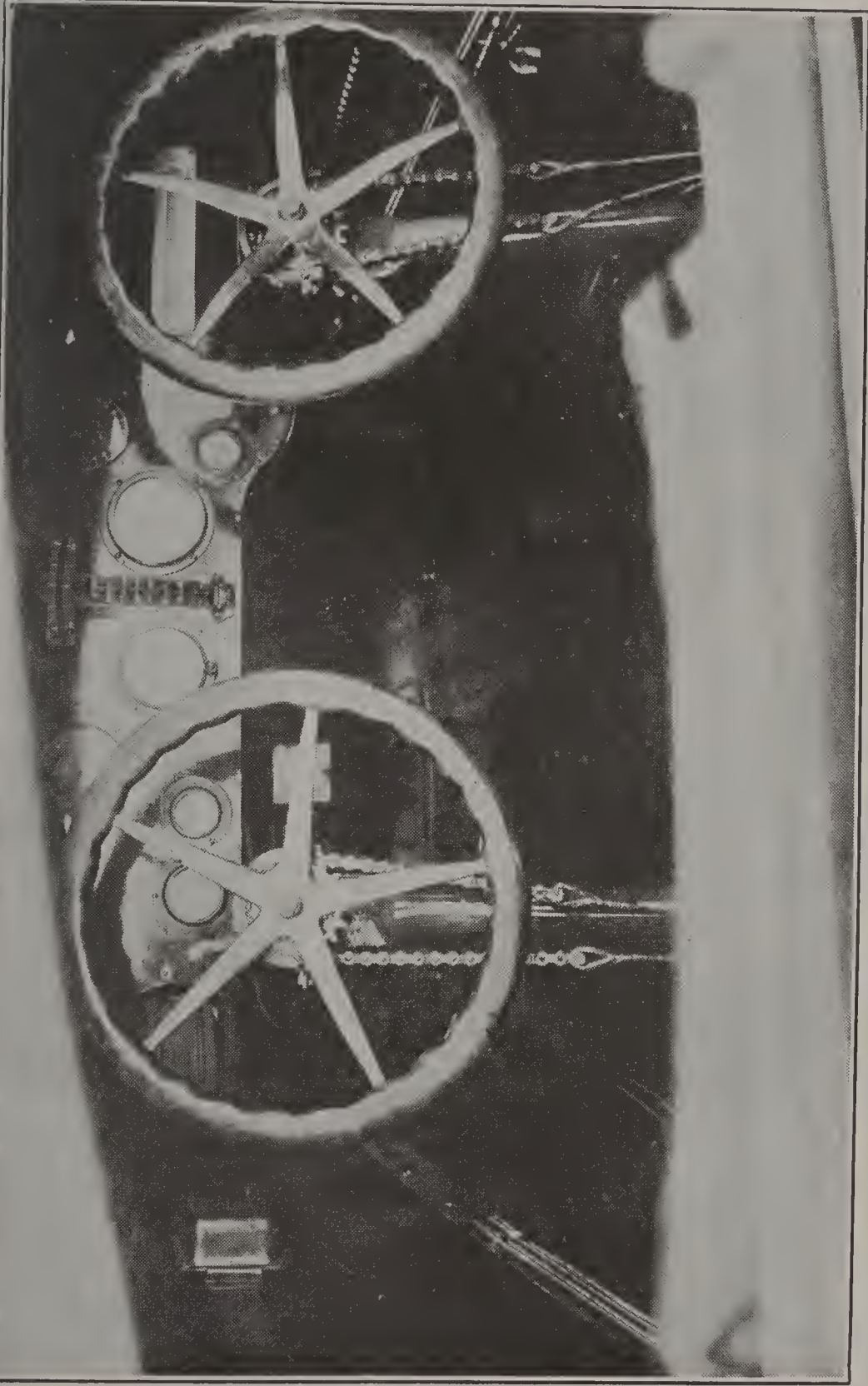


FIG. 39.—INSTRUMENT BOARD WITH PORT PILOT'S TELEPHONE STATION AT LEFT SIDE.

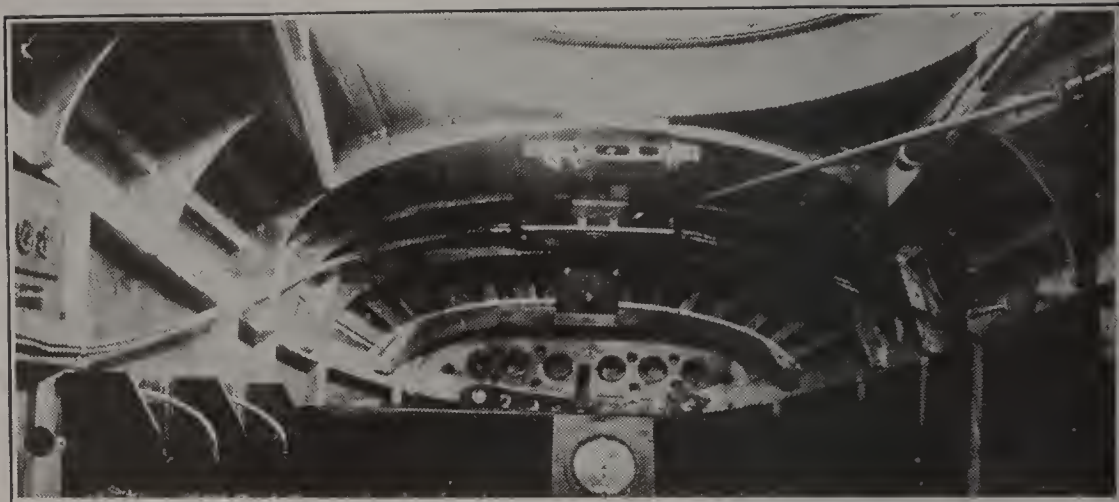


FIG. 40.—INTERIOR VIEW OF FORWARD GUNNER'S PIT. ON PORT SIDE IS SHOWN HEATING CONNECTION AND SWITCH. NOTE TRIGGERS FOR CONTROL OF BOMB RELEASE. INSTRUMENT IS AN ALTIMETER.



FIG. 41.—INSTRUMENT BOARD. BOMB SIGHT DIAL (OLD TYPE) IS ON STARBOARD AVIATOR'S SIDE. COMPASS IS ON PORT SIDE.

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## PART III

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### PACKING SHEETS

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NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

INDEX SHEET.

Boat No. ....

9 Packing Sheets.

8 Boxes.

Sheet No. 1 and 2 (Box No. 1), Hull.

Sheet No. 3 and 4 (Box No. 1), Instruments.

Sheet No. 5 (Boxes Nos. 2 and 6), Engine Foundations and  
Propellers.

Sheet No. 6 (Box No. 3), Main Panels.

Sheet No. 7 (Box No. 4), Tail Units.

Sheet No. 8 (Box No. 5), Wing Floats.

Sheet No. 9 (Boxes No. 7 and 8), Motors.

Date.

Time.

Left factory for yard:

Box No. 1, .....	.....
Box No. 2, .....	.....
Box No. 3, .....	.....
Box No. 4, .....	.....
Box No. 5, .....	.....
Box No. 6, .....	.....
Box No. 7, .....	.....
Box No. 8, .....	.....

Inspector, .....

(31)

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## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

Boat No. .... HULL. Sheet No. 1  
Box No. 1.

## Port Side, Stern to Bow.

- 1 boat hull, complete, with 1 lower tail clip, 1 upper tail clip.
- 4 horizontal stabilizer drift wires with 4 turnbuckles, 4 shackles with clevis pins.
- 4 horizontal stabilizer brace wire with 4 turnbuckles, 4 eye bolts with nuts.
- 2 horizontal stabilizer brace sockets with 2 bolts, nuts and lock washers.
- 1 horizontal brace-wire clip.
- 1 sidewalk brace wire clip, turnbuckle attached.
- 1 access door.
- 1 coil of  $\frac{1}{16}$ -inch flexible cable for bomb release.
- 4 sidewalk supporting bolts with nuts and lock washers.
- 1 pilot step.
- 1 rope cleat.

## Bow.

- 1 right and 1 left drift wire clip with 4 drift wires with 4 turnbuckles attached and 1 end of each wire open, 8 thimbles, 8 shackles with clevis pins, 2 triple connecting plates, 2 aileron control wires; 2 long and 2 short tie wires.
- 1 towing cable with rope attached leading through fitting in bow.
- 1 tow plate.

## Starboard Side, Bow to Stern.

- 1 pilot step.
- 1 coil of  $\frac{1}{16}$ -inch flexible cable for bomb release.
- 4 sidewalk supporting bolts with nuts and lock washers
- 1 sidewalk brace wire clip with turnbuckle attached.
- 1 access door.
- 1 brace wire clip.
- 2 horizontal stabilizer brace sockets with 2 bolts, nuts and lock washer.

Shortage.....

Remarks.....

Inspector .....

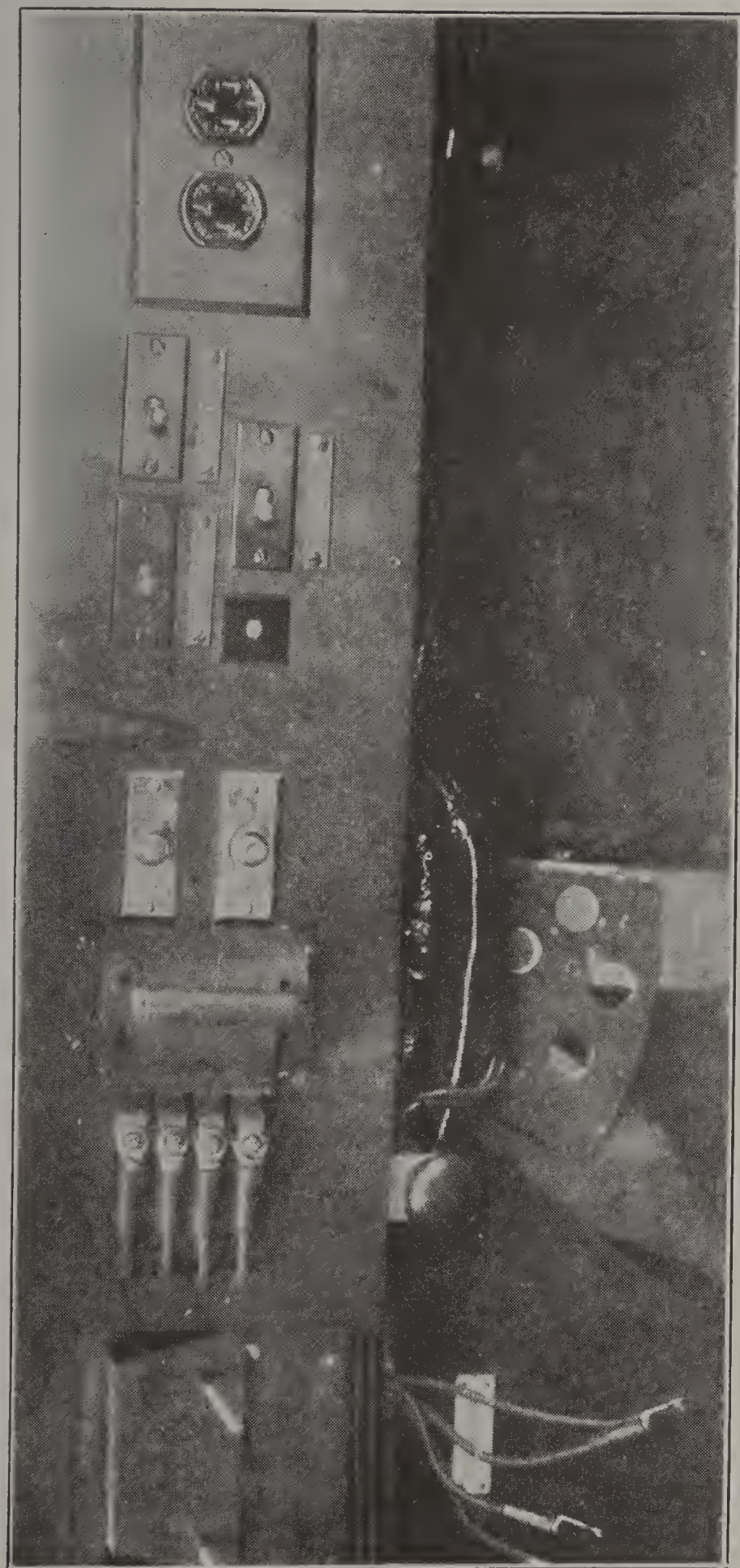


FIG. 42.—STARBOARD INNER GUNWALE. FOUR-POLE SWITCH CUTS OUT BOTH MOTORS. OTHER SWITCHES ARE FOR INSTRUMENT BOARD, RUNNING AND RANGE LIGHTS. ROUND BUTTON AT LEFT IS FOR SIGNALING RADIO OPERATOR. AT RIGHT IS LOCATED HEATING PLUG CONNECTION FOR RADIO OPERATOR.





FIG. 43.—LOOKING AFT OVER FUEL TANKS.

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

## EQUIPMENT ASSEMBLED INSIDE OF HULL.

Boat No. ....

Sheet No. 2.

Box No. 1.

1 bomb release with 6 pulleys, 8 flexible cables leading through tubing to port and starboard side.

1 Davis gun mount.

1 cleat.

8 ammunition trays.

1 generator box.

2 generator regulators.

2 rudder foot bars with 4 stirrups, 1 Sandow clip, 2 adjustable cable terminals and 4 control wires with turnbuckles, shackles and clevis pins.

1 rudder Sandow and 1 elevator Sandow.

2 Liberty switches.

2 pilots' seats with cushions.

1 double aileron and elevator control device complete with 1 check wire, 4 elevator control wires, 2 aileron control wires.

2 wind shields.

2 spark controls with 4 cables and 4 turnbuckles.

2 throttle controls with 4 cables and 4 turnbuckles.

1 battery box in fin recess on port side.

2 storage batteries.

5 gasoline tanks, each equipped with filler, cap and gauge, and 1 with flow sight box.

6 Pyrene fire extinguishers with brackets.

2 out-rigger gun mounts.

1 sliding door over rear gunner's cockpit.

1 bilge pump with hose.

1 windmill pump with all connections.

1 gasoline hand pump.

2 sidewalks.

4 sidewalk braces.

4 English bomb gears complete.

Very pistol cartridge rack.

Shortages.....

Remarks .....

Recd. from final assembly .....

Date packed .....

Packed by .....

Weight, net .....

Checked by .....

Weight, gross .....

Inspector .....

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

## INSTRUMENTS.

Boat No. ....

Sheet No. 3.

Box No. 1.

- 1 safety belt in forward gunner's cockpit.
- 1 Scarff ring gun mount in forward cockpit.
- 1 Scarff ring gun mount in after cockpit.
- 1 vertical compass, No. ...., Navy Standard I.
- 1 flat compass with two electric bulbs, No. ....
- 1 combination inclinometer, No. ....
- 2 oil pressure gauges, Nos. ....
- 2 tachometers, Nos. ....
- 1 airspeed meter, No. ....
- 1 radio clock, No. ....
- 2 altimeters, Nos. ....
- 1 four pole, one-way switch on starboard side.
- 2 dash light push button switches on starboard side.
- 2 dash lights on instrument board.
- 1 name plate.
- 1 airspeed meter horn with coil of  $\frac{1}{4}$ -inch copper tubing.
- 3 wiring diagrams; ignition, telephone, heating and lighting.
- 1 bomb sight telltale on instrument board.
- 1 bomb sight Mark V, No. ....
- 1 bomb sight fixture on bow.
- 2 oil thermometers, Nos. ....
- 2 water thermometers, Nos. ....
- 3 spare 15-foot thermometer tubes, Nos. ....
- 1 spare 18-foot thermometer tube, No. ....
- Spare parts as per specification PSP-7.
- 1 package of construction blue prints for assembly of boat, drawings  
Nos. 41102, 5412, 5414, 6326, 6327, 6323, 6332, 6833, 5834, 5835,  
and 6836.

Shortage.....

Remarks .....



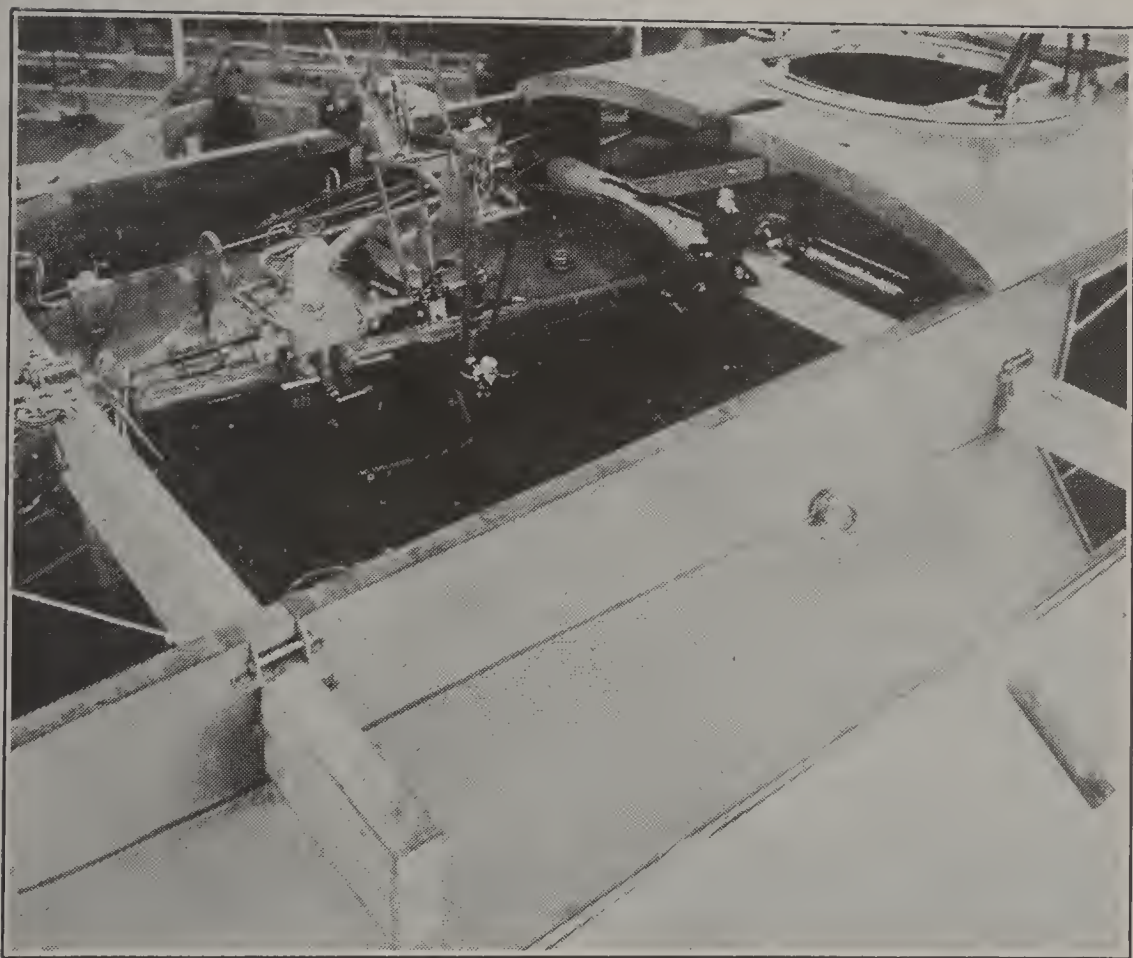


FIG. 44.—THREE-QUARTER VIEW LOOKING AFT OVER GASOLINE TANKS AND LOWER PIPING. READY FOR SHIPMENT.

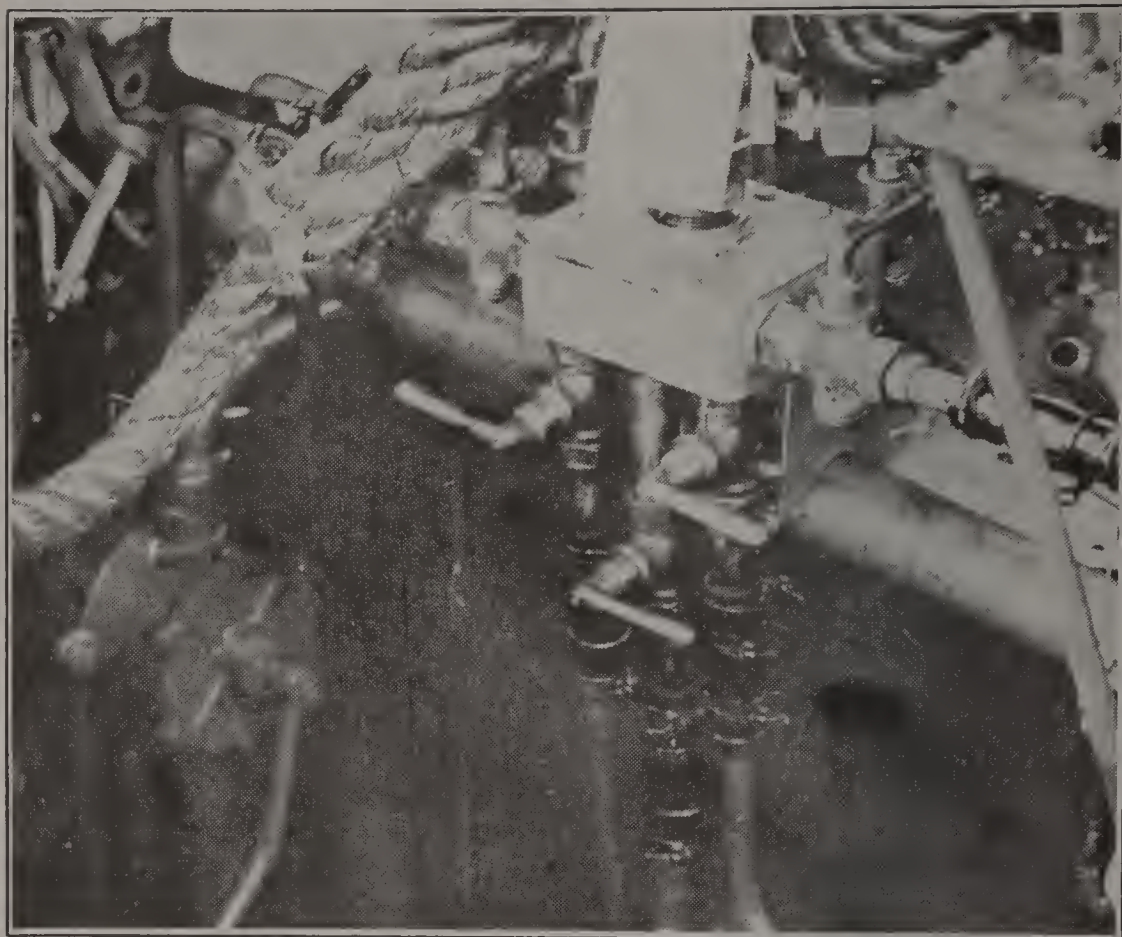


FIG. 45.—GASOLINE MANIFOLD SHOWING CUT-OFF VALVES TO VARIOUS TANKS AND WIND PUMP.

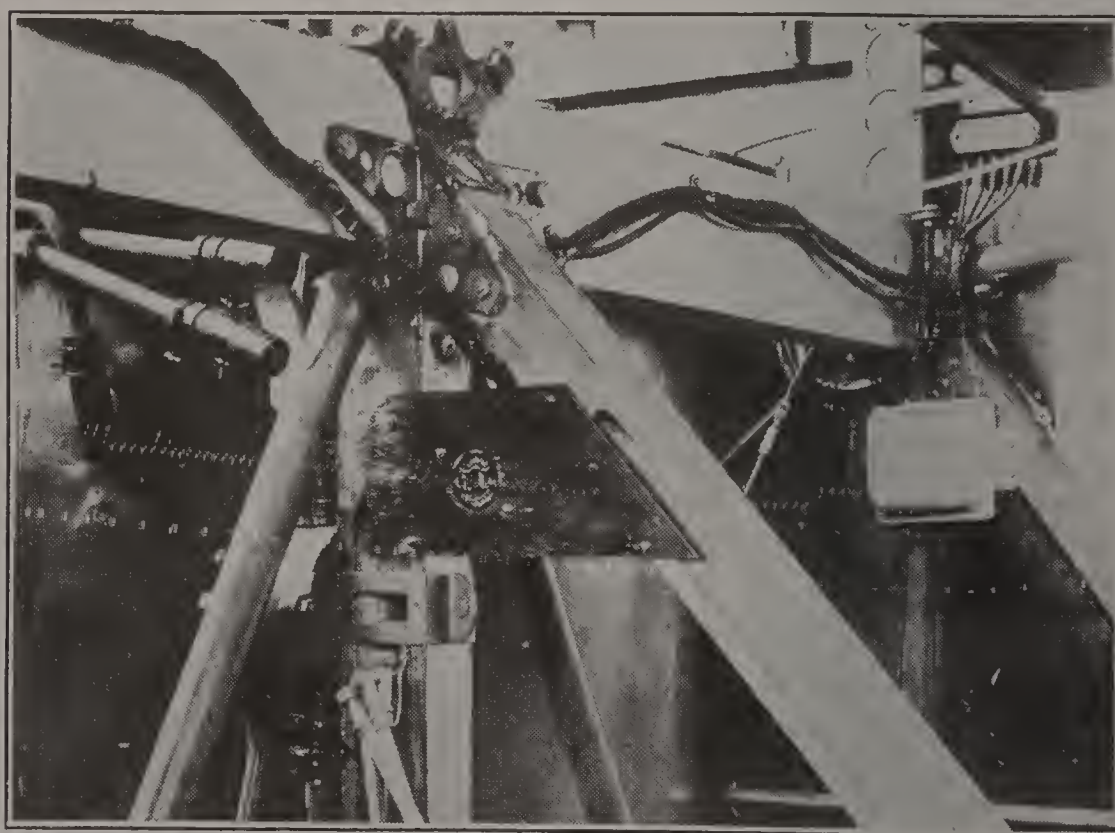


FIG. 46.—AFTER COCKPIT. TELEPHONE STATION IS LOCATED ON STARBOARD SIDE OF HULL JUST FORWARD OF ACCESS DOOR. HEATING CONNECTION IS SHOWN ATTACHED TO CENTER STANCHION. ON FORWARD SIDE OF STANCHION IS HAND GASOLINE PUMP.

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

## INSTRUMENTS—(continued.)

Boat No. ....

Sheet No. 4.

Box No. 1.

- 1 telephone outfit, complete:
  - 4 standard station boxes.
  - Cable.
  - 1 radio operator's station box.
  - 1 battery and container assembled in hull.
  - 1 extra battery.
  - 4 mouthpieces.
  - 4 telephone headgear sets.
- 1 radio outfit, complete:
  - 1 radio transmitter outfit.
  - 1 receiver, No. ....
  - 3 vacuum tubes.
  - 1 collapsible mast.
  - 1 24-volt storage battery.
  - 1 antenna system, No. ....
  - 1 generator, No. ....
  - 1 box spare parts, No. ....
  - 1 radio compass.
- 1 heating and lighting outfit, complete:
  - Interior hull wiring.
  - 1 green running light.
  - 1 red running light.
  - 1 white range light.
  - Outside wiring.

Shortages.....

Remarks.....

Checked by.....

Inspector.....

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

Sheet No. 5.

Box No. 2.

Box No. 6.

Boat No. ....

## ENGINE FOUNDATIONS WITH EQUIPMENT, BOX NO. 2.

- 1 port and 1 starboard engine foundation with 8  $\wedge$  braces and 8 V struts.
- 8 cables with turnbuckles, shackles and clevis pins.
- 4 pulleys.
- 2 split brass bushings for starter.
- 2 distributor arms and 2 connecting rods.
- 1 port radiator, No. ...., with 2 wires and 2 braces.
- 1 starboard radiator, No. ...., with 2 wires and 2 braces.
- 4 oil tanks with 12 clamps and 4 pieces of  $\frac{1}{4}$ -inch copper tubing.
- 90 hose clamps.
- 2 large water pipes with 2 plugs and 6 hose connections.
- 4 water pipe brackets.
- 28 engine bed bolts.
- 4 T oil lines with 12 hose connections.
- 2 priming pumps.

Shortages.....

Remarks.....

Weight.....

Date packed.....

Packed by .....

Inspector.....

## PROPELLERS, BOX NO. 6.

8 propellers, Nos. ....

Weight.....

Date packed.....

Packed by.....

Inspector.....



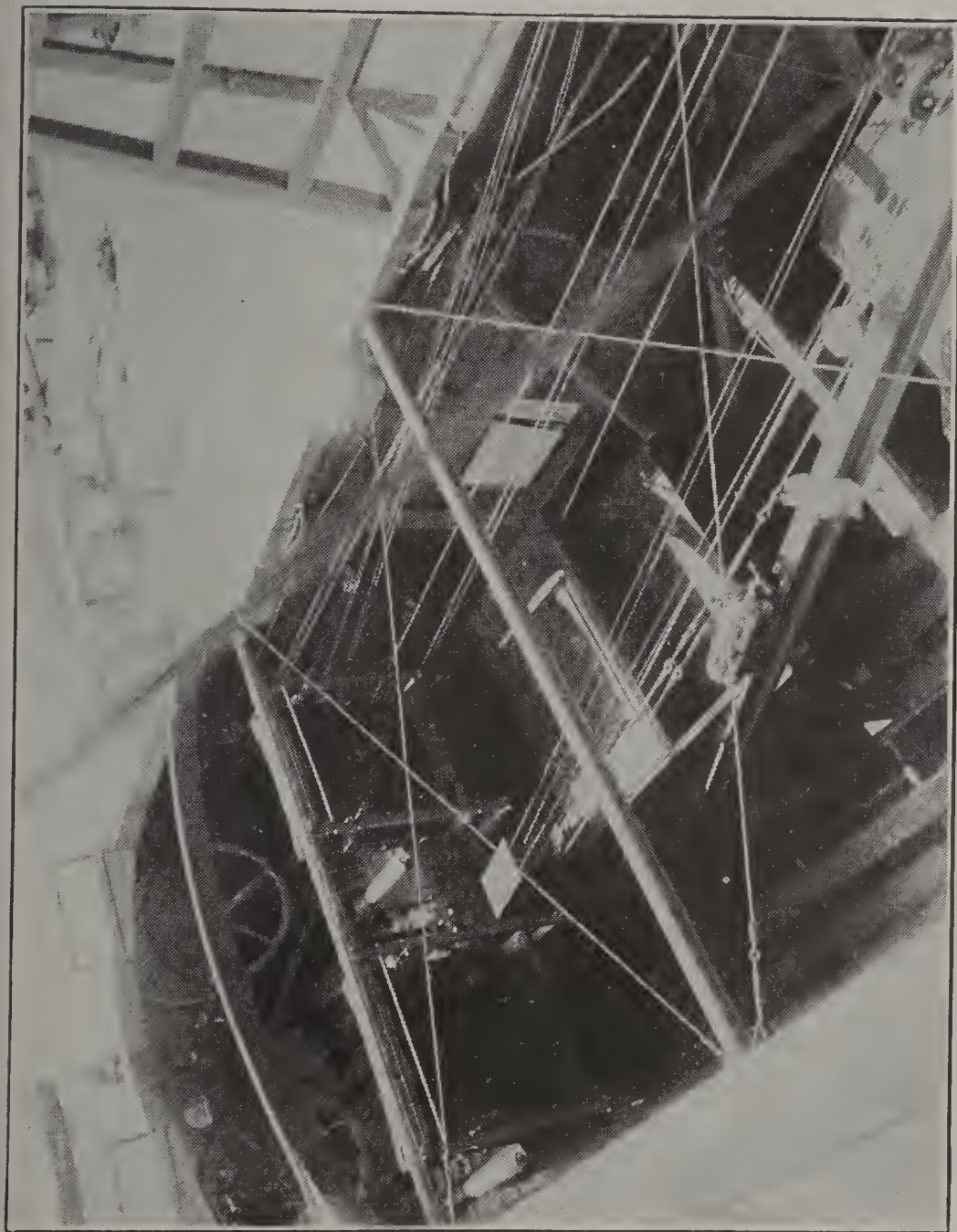


FIG. 47.—HULL INTERIOR, FORWARD SECTION, SHOWING TWO STATIONS OF  
TELEPHONE SYSTEM.





FIG. 48.—TAIL BRACE ASSEMBLY.

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

## MAIN PANEL BOX.

Sheet No. 6.

Box No. 3.

Boat No. ....

1 right and 1 left intermediate panel, each with 4 hinge pins in female hinges, 4 male hinges, 6 post sockets with bolts, nuts, and cotters, 2 aileron control wires and 23 cables with turnbuckles attached.

1 right and 1 left lower panel each with 6 post sockets, bolts, nuts and cotters, 4 male hinges and 4 sets of English bomb clips.

2 nonskids, 1 right and 1 left, each with 6 cables and turnbuckles.

1 right and 1 left aileron with 10 hinge pins in female hinges; 10 bolts, nuts, and cotters.

12 interplane struts numbered from 1 to 12.

1 right and 1 left upper outer panel each with 14 male hinges, 4 cables with turnbuckles attached and 4 V-bolts with pulleys attached.

8 ailerons, horns with wires, bolts and nuts.

Shortage.....

Remarks.....

Weight.....

Date packed.....

Packed by.....

Checked by.....

Inspector.....

## NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

## TAIL UNIT BOX.

Sheet No. 7.

Box No. 4

Boat No. ....

- 1 engine section panel with gravity tank, 8 hinge pins in female hinges, 6 post sockets with bolts, nuts, and cotters; 30 cables with turnbuckles attached, and 4 pulleys.
- 1 horizontal stabilizer with 8 brace fittings, 10 hinge pins in female hinges and 10 bolts, nuts and cotters, 4 wire guides.
- 2 elevators each equipped with 5 male hinges, 5 bolts, nuts and cotters.
- 1 rudder balance with 2 wires and fittings.
- 1 rudder with 7 female hinges.
- 1 vertical stabilizer with 7 male hinges with hinge pins and 1 horizontal stabilizer brace fitting.
- 4 rudder horns.
- 8 elevator horns.
- 8 horizontal stabilizer braces with fittings.
- 4 diagonal braces with ignition wires and guides.
- 2 gasoline lines.
- 2 center section struts with gasoline lines attached.

Shortage.....

Remarks.....

Weight.....

Date packed.....

Packed by .....

Checked by.....

Inspector.....

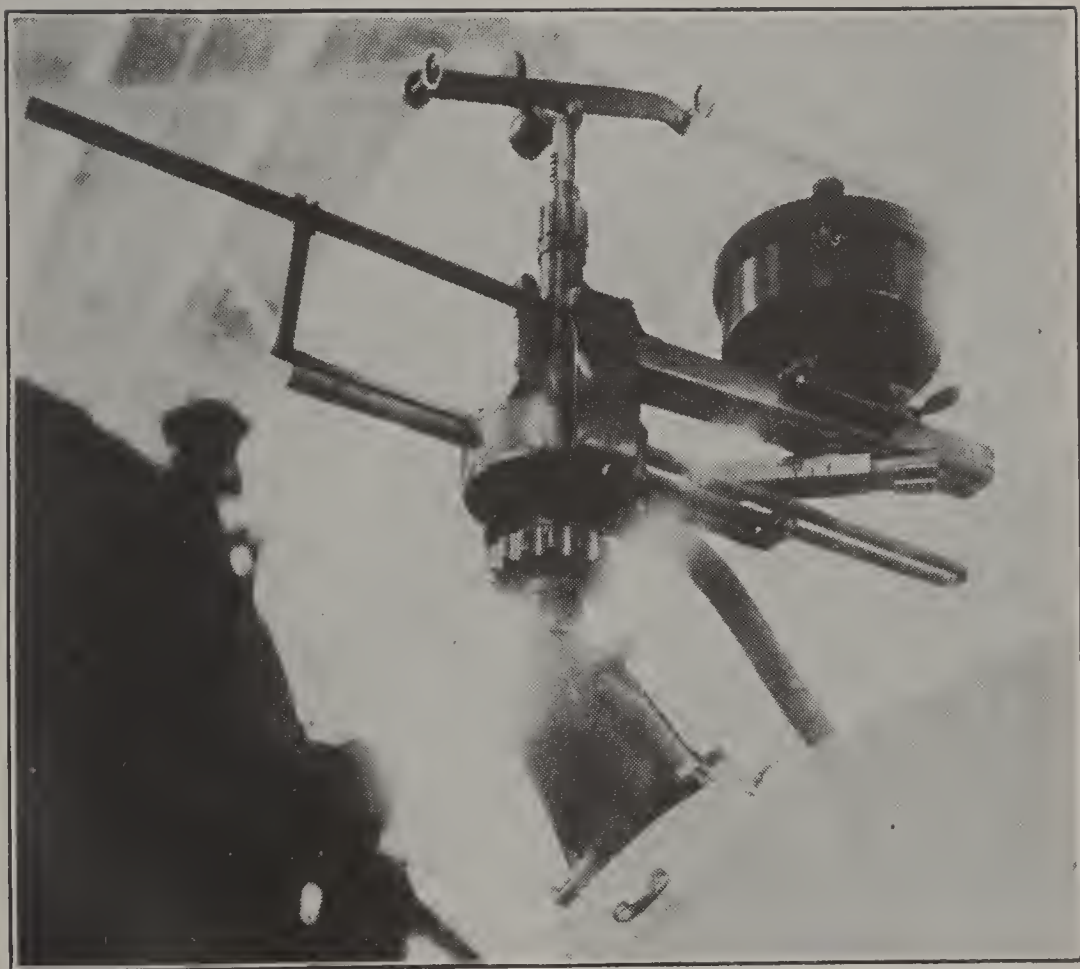


FIG. 49.—SIDE VIEW OF NEW TYPE BOMB SIGHT ATTACHED TO BOW.

90245°—19—5

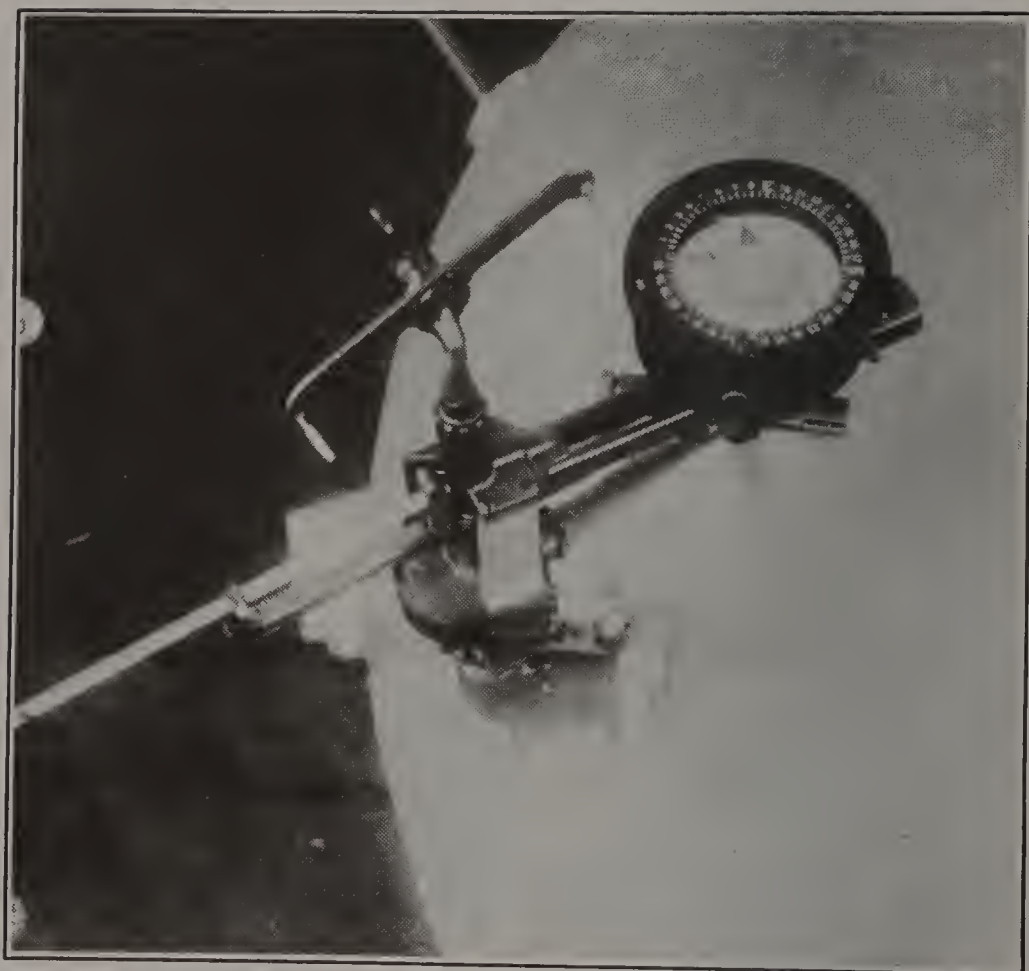


FIG. 50.—TOP VIEW OF NEW TYPE BOMB SIGHT ATTACHED TO BOW.



NAVAL AIRCRAFT FACTORY.

*Packing List for F-5L Boat Seaplane.*

WING FLOATS.

Boat No. ....

Sheet No. 8.  
Box No. 5.

- 2 wing floats with 8 fittings.
- 8 washer plates.
- 8 wooden blocks.
- 16 bolts, nuts, cotters, and flat and bevel washers.

Shortage.....  
Remarks.....  
Weight.....  
Date packed.....  
Packed by.....

Checked by.....  
Inspector.....

NAVAL AIRCRAFT FACTORY.  
*Packing List for F-5L Boat Seaplane.*

Boat No.....

Sheet No. 9.  
Box No. 7.  
Box No. 8.

PORT MOTOR, BOX NO. 7.

- 1 Port motor, Navy No. .... Maker ..... Starter, No.....
- 1 fair lead with bracket.
- 1 gas strainer with 2 pipe connections.
- 1 carburetor control rod with pulley.
- 1 carburetor overflow pipe.
- 1 oil line.
- 1 motor cover.
- 1 log book.
- 1 kit of tools.
- 1 box of spare motor parts.
- 1 primer.
- 1 propeller hub.
- Shortage.....
- Remarks.....
- Weight.....
- Date packed .....
- Packed by.....
- Inspector.....

STARBOARD MOTOR, BOX NO. 8.

- 1 Starboard motor, Navy No. .... Maker ..... Starter, No.....
- 1 fair lead with bracket.
- 1 gas strainer with 2 pipe connections.
- 1 carburetor control rod with pulley.
- 1 carburetor overflow pipe.
- 1 oil line.
- 1 motor cover.
- 1 log book.
- 1 kit of tools.
- 1 box of spare motor parts.
- 1 primer.
- 1 propeller hub.
- Shortage.....
- Remarks.....
- Weight.....
- Date packed .....
- Packed by.....
- Inspector.....

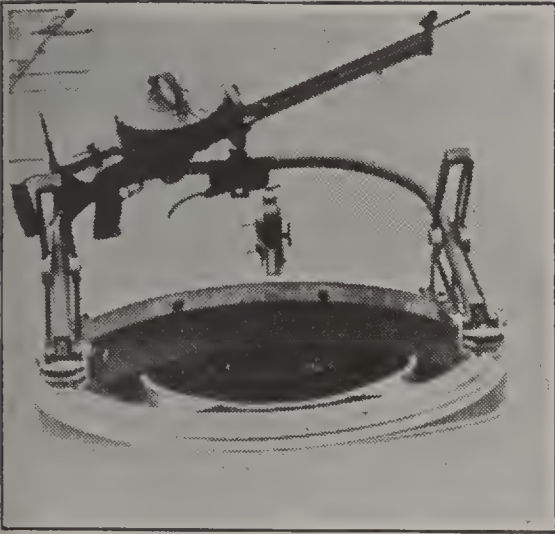


FIG. 51a.—REAR VIEW OF BOW GUN MOUNT.

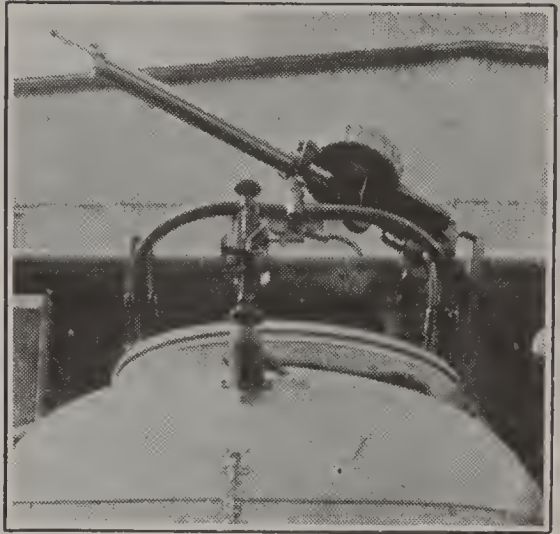


FIG. 51b.—FRONT VIEW OF BOW GUN MOUNT.

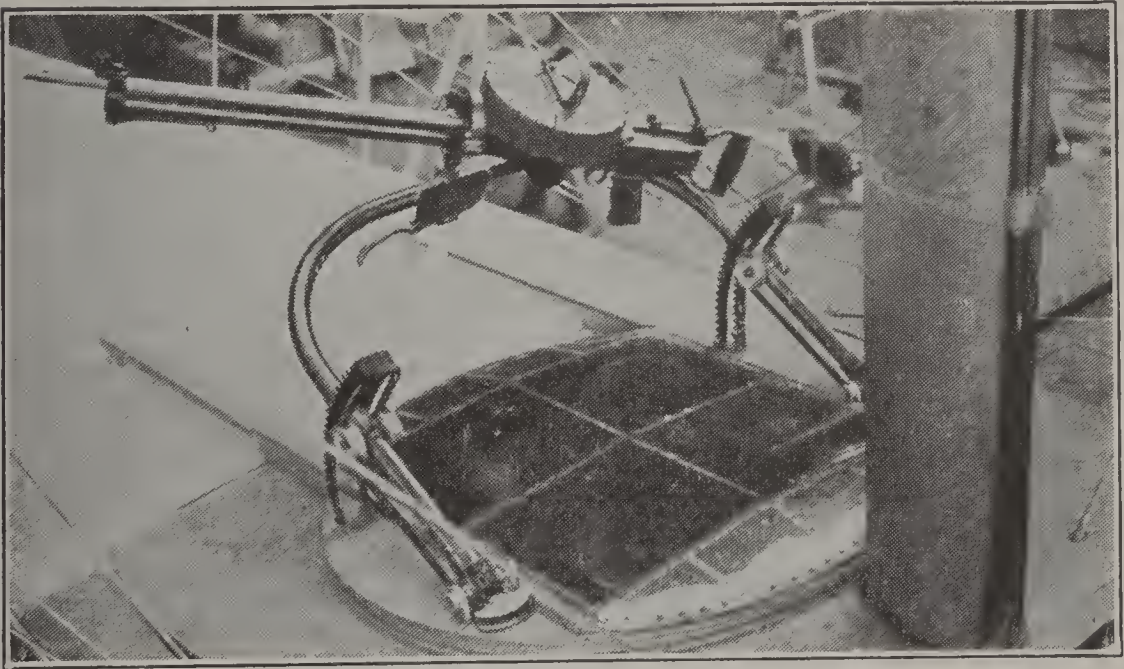


FIG. 52.—REAR GUN MOUNT, HATCH COVER CLOSED.



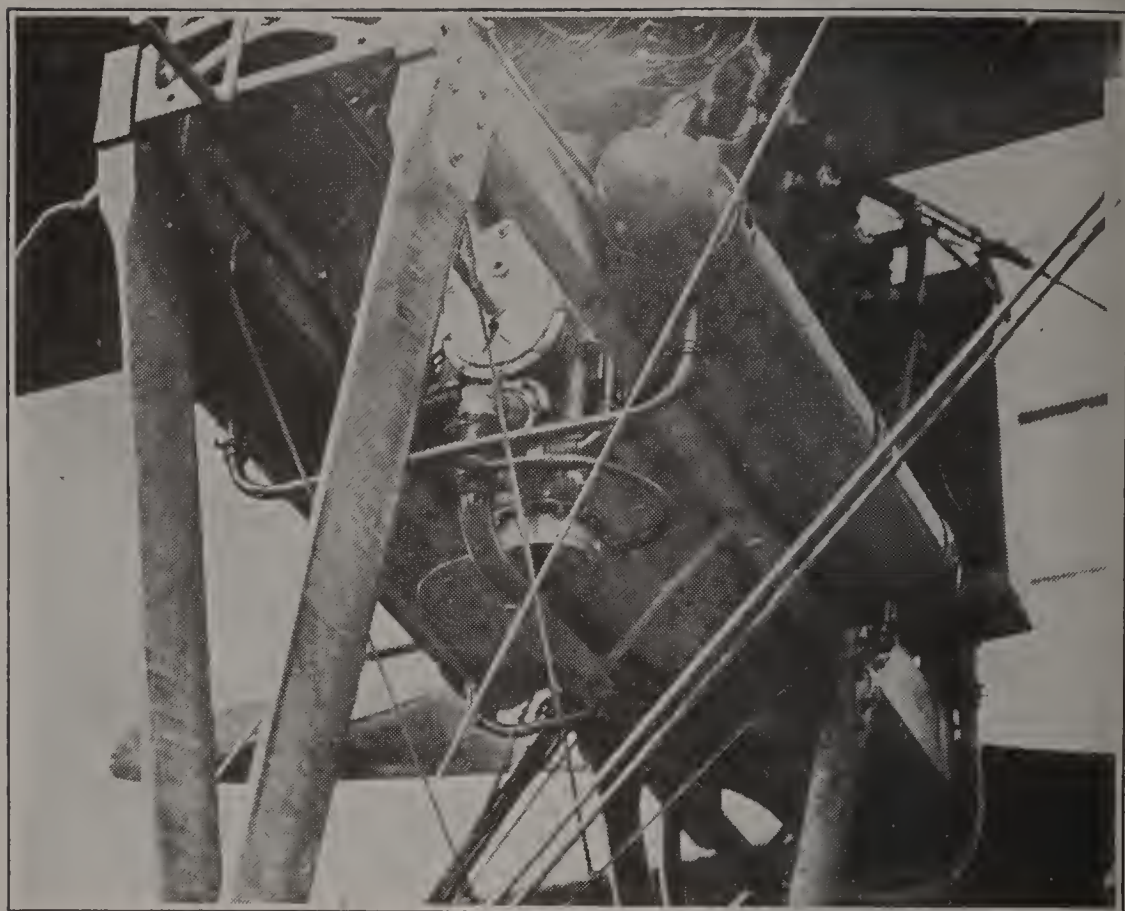


FIG. 53a.—VIEW OF MOTOR WITH OIL AND WATER PIPING. LOOKING FORWARD



FIG. 53b.—VIEW OF MOTOR FROM UNDERNEATH. LOOKING AFT.



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## PART IV

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### TABLES

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TABLE NO. 1.—*Specific gravity equivalents for degrees Baumé for liquids lighter than water.*

Formula; Degrees Baumé =  $\frac{140}{\frac{60^\circ}{\text{Sp. gr.}} - 60^\circ} = 130$

[Sp. gr. taken at 60° F. and referred to distilled water at 60° F.]

Baumé.	Specific gravity.	Pounds per gallon.	Baumé.	Specific gravity.	Pounds per gallon.	Baumé.	Specific gravity.	Pounds per gallon.
10	1.0000	8.33	37	0.8383	6.98	64	0.7217	6.01
11	.9929	8.27	38	.8333	6.94	65	.7179	5.98
12	.9859	8.21	39	.8285	6.90	66	.7143	5.95
13	.9790	8.16	40	.8235	6.86	67	.7107	5.92
14	.9722	8.10	41	.8187	6.82	68	.7071	5.89
15	.9655	8.04	42	.8139	6.78	69	.7035	5.86
16	.9589	7.99	43	.8092	6.74	70	.7000	5.83
17	.9524	7.93	44	.8046	6.70	71	.6965	5.80
18	.9459	7.88	45	.8000	6.66	72	.6931	5.78
19	.9396	7.83	46	.7955	6.63	73	.6897	5.75
20	.9333	7.78	47	.7909	6.59	74	.6863	5.72
21	.9272	7.72	48	.7865	6.55	75	.6829	5.69
22	.9211	7.67	49	.7821	6.52	76	.6796	5.66
23	.9150	7.62	50	.7777	6.48	77	.6763	5.63
24	.9091	7.57	51	.7735	6.44	78	.6730	5.60
25	.9032	7.53	52	.7692	6.41	79	.6698	5.58
26	.8974	7.48	53	.7650	6.37	80	.6666	5.55
27	.8917	7.43	54	.7609	6.34	81	.6635	5.52
28	.8861	7.38	55	.7568	6.30	82	.6604	5.50
29	.8805	7.34	56	.7527	6.27	83	.6573	5.48
30	.8750	7.29	57	.7487	6.24	84	.6542	5.45
31	.8696	7.24	58	.7447	6.20	85	.6511	5.42
32	.8642	7.20	59	.7407	6.17	86	.6481	5.40
33	.8589	7.15	60	.7368	6.14	87	.6451	5.38
34	.8537	7.11	61	.7329	6.11	88	.6422	5.36
35	.8485	7.07	62	.7292	6.07	89	.6392	5.33
36	.8433	7.03	63	.7254	6.04	90	.6363	5.30

TABLE NO. II.—*Metric conversion table.*

[English to Metric.]

English units.	Hundredths of an inch to millimeters.	Feet to meters.	Miles to kilometers.	Gallons to liters.	Pounds to kilograms.
1 .....	0.254	0.30480	1.6093	3.7853	0.45359
2 .....	.508	.60960	3.2187	7.5707	.90718
3 .....	.762	.91440	4.8280	11.3560	1.36078
4 .....	1.016	1.21920	6.4374	15.1413	1.81437
5 .....	1.270	1.52400	8.0467	18.9267	2.26796
6 .....	1.524	1.82880	9.6561	22.7120	2.72155
7 .....	1.778	2.13360	11.2654	26.4973	3.17515
8 .....	2.032	2.43840	12.8748	30.2827	3.62874
9 .....	2.286	2.74321	14.4841	34.0680	4.08233
10 .....	2.540	3.04801	16.0935	37.8533	4.53592
11 .....	2.794	3.35281	17.7028	41.6387	4.98552
12 .....	3.048	3.65761	19.3122	45.4240	5.44311
13 .....	3.302	3.96241	20.9215	49.2093	5.89670
14 .....	3.556	4.26721	22.5309	52.9947	6.35029
15 .....	3.810	4.57201	24.1402	56.7800	6.80389
16 .....	4.064	4.87681	25.7496	60.5653	7.25748
17 .....	4.318	5.18161	27.3589	64.3506	7.71107
18 .....	4.572	5.48641	28.9682	68.1360	8.16466
19 .....	4.826	5.79121	30.5776	71.9213	8.61826
20 .....	5.080	6.09601	32.1869	75.7066	9.07185
21 .....	5.334	6.40081	33.7963	79.4920	9.52544
22 .....	5.588	6.70561	35.4056	83.2773	9.97903
23 .....	5.842	7.01041	37.0150	87.0626	10.43263
24 .....	6.096	7.31521	38.6243	90.8480	10.88622
25 .....	6.350	7.62002	40.2337	94.6333	11.33981
26 .....	6.604	7.92482	41.8430	98.4186	11.79340
27 .....	6.858	8.22962	43.4524	102.2040	12.24700
28 .....	7.112	8.53442	45.0617	105.9893	12.70059
29 .....	7.366	8.83922	46.6711	109.7746	13.15418
30 .....	7.620	9.14402	48.2804	113.5600	13.60777
31 .....	7.874	9.44882	49.8898	117.3453	14.08137
32 .....	8.128	9.75362	51.4991	121.1306	14.51496
33 .....	8.382	10.05842	53.1085	124.9160	14.96855
34 .....	8.636	10.36322	54.7178	128.7013	15.42214
35 .....	8.890	10.66802	56.3272	132.4866	15.87573
36 .....	9.144	10.97282	57.9365	136.2720	16.32933
37 .....	9.398	11.27762	59.5458	140.0573	16.78292
38 .....	9.652	11.58242	61.1552	143.8426	17.23651
39 .....	9.906	11.88722	62.7645	147.6280	17.69010
40 .....	10.160	12.19202	64.3739	151.4133	18.14370
41 .....	10.414	12.49682	65.9832	155.1986	18.59729
42 .....	10.668	12.80163	67.5926	158.9840	19.05088
43 .....	10.922	13.10643	69.2019	162.7693	19.50447
44 .....	11.176	13.41123	70.8113	166.5546	19.95807
45 .....	11.430	13.71603	72.4206	170.3400	20.41166
46 .....	11.684	14.02083	74.0300	174.1253	20.86525
47 .....	11.938	14.32563	75.6393	177.9106	21.31880
48 .....	12.192	14.63043	77.2487	181.6960	21.77244
49 .....	12.446	14.93523	78.8580	185.4813	22.22603
50 .....	12.700	15.24003	80.4674	189.2666	22.67962
100 .....	25.400	30.48006	160.9347	378.53 0	45.35921





FIG. 54.--THREE-QUARTER REAR VIEW OF CENTER SECTION.

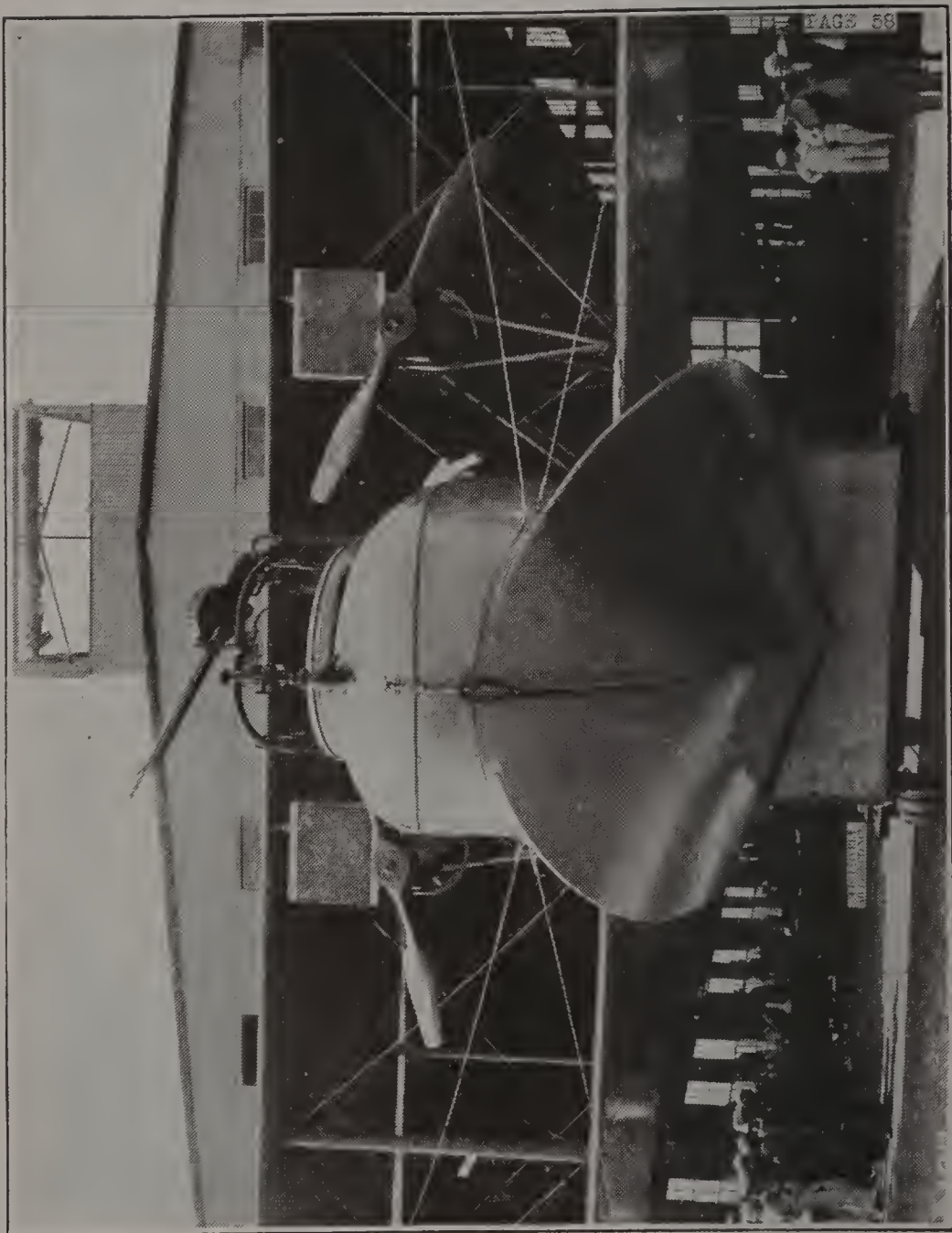


FIG. 55.—FRONT VIEW OF COMPLETE ASSEMBLY.

TABLE NO. III.—*Metric conversion table.*

[Metric to English.]

Metric units.	Millimeters to inches.	Meters to feet.	Kilometers to miles.	Liters to gallons.	Kilograms to pounds.
1.....	0.03937	3.28083	0.62137	0.26418	2.2046
2.....	.07874	6.56167	1.24274	.52836	4.4092
3.....	.11811	9.84250	1.86411	.79253	6.6139
4.....	.15748	13.12333	2.48548	1.05671	8.8185
5.....	.19685	16.40417	3.10685	1.32089	11.0231
6.....	.23622	19.68500	3.72822	1.58507	13.2277
7.....	.27559	22.96583	4.34959	1.84924	15.4324
8.....	.31496	26.24667	4.97096	2.11342	17.6370
9.....	.35433	29.52750	5.59233	2.37760	19.8416
10.....	.39370	32.80833	6.21370	2.64178	22.0462
11.....	.43307	36.08917	6.83507	2.90595	24.2508
12.....	.47244	39.37000	7.45644	3.17013	26.4555
13.....	.51181	42.65083	8.07781	3.43431	28.6601
14.....	.55118	45.93167	8.69918	3.69849	30.8647
15.....	.59055	49.21250	9.32055	3.96266	33.0693
16.....	.62992	52.49333	9.94192	4.22684	35.2740
17.....	.66929	55.77417	10.56329	4.49102	37.4786
18.....	.70866	59.05500	11.18466	4.75520	39.6832
19.....	.74803	62.33583	11.80603	5.01937	41.8878
20.....	.78740	65.61667	12.42740	5.28355	44.0924
21.....	.82677	68.89750	13.04877	5.54773	46.2971
22.....	.86614	72.17833	13.67014	5.81191	48.5017
23.....	.90551	75.45917	14.29151	6.07608	50.7063
24.....	.94488	78.74000	14.91288	6.34026	52.9109
25.....	.98425	82.02083	15.53425	6.60444	55.1156
26.....	1.02362	85.30167	16.15562	6.86862	57.3202
27.....	1.06299	88.58250	16.77699	7.13280	59.5248
28.....	1.10236	91.86333	17.39836	7.39697	61.7294
29.....	1.14173	95.14417	18.01973	7.66115	63.9340
30.....	1.18110	98.42500	18.64110	7.92533	66.1387
31.....	1.22047	101.70583	19.26247	8.18951	68.3433
32.....	1.25984	104.98667	19.88384	8.45368	70.5479
33.....	1.29921	108.26750	20.50521	8.71786	72.7525
34.....	1.33858	111.54833	21.12658	8.98204	74.9572
35.....	1.37795	114.82917	21.74795	9.24622	77.1618
36.....	1.41732	118.11000	22.36932	9.51039	79.3664
37.....	1.45669	121.39083	22.99069	9.77457	81.5710
38.....	1.49606	124.67167	23.61206	10.03875	83.7756
39.....	1.53543	127.95250	24.23343	10.30293	85.9803
40.....	1.57480	131.23330	24.85480	10.56710	88.1849
41.....	1.61417	134.51417	25.47617	10.83128	90.3895
42.....	1.65354	137.79500	26.09754	11.09546	92.5941
43.....	1.69291	141.07583	26.71891	11.35964	94.7988
44.....	1.73228	144.35667	27.34028	11.62381	97.0034
45.....	1.77165	147.63750	27.96165	11.88799	99.2080
46.....	1.81102	150.91833	28.58302	12.15217	101.4126
47.....	1.85039	154.19917	29.20439	12.41635	103.6173
48.....	1.88976	157.48000	29.82576	12.68052	105.8219
49.....	1.92913	160.76083	30.44713	12.94470	108.0265
50.....	1.96850	164.04167	31.06850	13.20888	110.2311
100.....	3.93700	328.08334	62.13700	26.41776	220.4622



TABLE NO. IV.—*Variation of wind velocity with altitude during the day.*

Elevation.	Velocities in miles per hour.				
Surface.....	5	10	15	20	25
500 feet.....	7	15	21	28	35
1,000 feet.....	8	18	26	34	43
2,000 feet.....	8	18	28	37	47
3,000 feet.....	8	18	29	40	49
4,000 feet.....	10	19	29	40	50
5,000 feet.....	13	20	29	40	50

TABLE NO. IV.—*Variation of direction of wind and altitude.*

[Upper-region winds vary in direction from those near the earth's surface. The amount of deviation is given approximately in the tabulation.]

Elevation.	Devia- tion to right in degrees.	Directions.			
Surface.....	0	N.....	E.....	S.....	W.....
500 feet.....	5	N. $\frac{1}{2}$ E.....	E. $\frac{1}{2}$ S.....	S. $\frac{1}{2}$ W.....	W. $\frac{1}{2}$ N.....
1,000 feet...	10	N. by E.....	E. by S.....	S. by W.....	W. by N.....
2,000 feet...	16	N. by E. $\frac{1}{2}$ E.....	E. by S. $\frac{1}{2}$ S.....	S. by W. $\frac{1}{2}$ W.....	W. by N. $\frac{1}{2}$ N.....
3,000 feet...	19	N. by E. $\frac{3}{4}$ E.....	E. by S. $\frac{3}{4}$ S.....	S. by W. $\frac{3}{4}$ W.....	W. by N. $\frac{3}{4}$ N.....
4,000 feet...	20	NNE.....	ESE.....	SSW.....	WNW.....
5,000 feet...	21	NNE.....	ESE.....	SSW.....	WNW.....





FIG. 56.—STAGING FOR WING ASSEMBLY.



TABLE VI.—*Compass points and their equivalents.*

° /	Points.	° /	Points.	° /	Points.	° /	Points
0 00	N	90 00	E	180 00	S	270 00	W
2 49	N $\frac{1}{4}$ E	92 49	E $\frac{1}{4}$ S	182 49	S $\frac{1}{4}$ W	272 49	W $\frac{1}{4}$ N
5 38	N $\frac{1}{2}$ E	95 38	E $\frac{1}{2}$ S	185 38	S $\frac{1}{2}$ W	275 38	W $\frac{1}{2}$ N
8 26	N $\frac{3}{4}$ E	98 26	E $\frac{3}{4}$ S	188 26	S $\frac{3}{4}$ W	278 26	W $\frac{3}{4}$ N
11 15	N by E	101 15	E by S	191 15	S by W	281 15	W by N
14 04	N by E $\frac{1}{4}$ E	104 04	ESE $\frac{3}{4}$ E	194 04	S by W $\frac{1}{4}$ W	284 04	WNW $\frac{3}{4}$ W
16 53	N by E $\frac{1}{2}$ E	106 53	ESE $\frac{1}{2}$ E	196 53	S by W $\frac{1}{2}$ W	286 53	WNW $\frac{1}{2}$ W
19 41	N by E $\frac{3}{4}$ E	109 41	ESE $\frac{1}{4}$ E	199 41	S by W $\frac{3}{4}$ W	289 41	WNW $\frac{1}{4}$ W
22 30	NNE	112 30	ESE	202 30	SSW	292 30	WNW
25 19	NNE $\frac{1}{4}$ E	115 19	SE by E $\frac{3}{4}$ E	205 19	SSW $\frac{1}{4}$ W	295 19	NW by W $\frac{3}{4}$ W
28 08	NNE $\frac{1}{2}$ E	118 08	SE by E $\frac{1}{2}$ E	208 08	SSW $\frac{1}{2}$ W	298 08	NW by W $\frac{1}{2}$ W
30 56	NNE $\frac{3}{4}$ E	120 56	SE by E $\frac{1}{4}$ E	210 56	SSW $\frac{3}{4}$ W	300 56	NW by W $\frac{1}{4}$ W
33 45	NE by N	123 45	SE by E	213 45	SW by S	303 45	NW by W
36 34	NE $\frac{3}{4}$ N	126 34	SE $\frac{3}{4}$ E	216 34	SW $\frac{3}{4}$ S	306 34	NW $\frac{3}{4}$ W
39 23	NE $\frac{1}{2}$ N	129 23	SE $\frac{1}{2}$ E	219 23	SW $\frac{1}{2}$ S	309 23	NW $\frac{1}{2}$ W
42 11	NE $\frac{1}{4}$ N	132 11	SE $\frac{1}{4}$ E	222 11	SW $\frac{1}{4}$ S	312 11	NW $\frac{1}{4}$ W
45 00	NE	135 00	SE	225 00	SW	315 00	NW
47 49	NE $\frac{1}{4}$ E	137 49	SE $\frac{1}{4}$ S	227 49	SW $\frac{1}{4}$ W	317 49	NW $\frac{1}{4}$ N
50 38	NE $\frac{1}{2}$ S	140 38	SE $\frac{1}{2}$ S	320 38	SW $\frac{1}{2}$ W	320 38	NW $\frac{1}{2}$ N
53 26	NE $\frac{3}{4}$ E	143 26	SE $\frac{3}{4}$ S	233 26	SW $\frac{3}{4}$ W	323 26	NW $\frac{3}{4}$ N
56 15	NE by E	146 15	SE by S	236 15	SW by W	326 15	NW by N
59 04	NE by E $\frac{1}{4}$ E	149 04	SSE $\frac{3}{4}$ E	239 04	SW by W $\frac{1}{4}$ W	329 04	NNW $\frac{3}{4}$ W
61 53	NE by E $\frac{1}{2}$ E	151 53	SSE $\frac{1}{2}$ E	241 53	SW by W $\frac{1}{2}$ W	331 53	NNW $\frac{1}{2}$ W
64 41	NE by E $\frac{3}{4}$ E	154 41	SSE $\frac{1}{4}$ E	244 41	SW by W $\frac{3}{4}$ W	334 41	NNW $\frac{1}{4}$ W
67 30	ENE	157 30	SSE	247 30	WSW	337 30	NNW
70 19	ENE $\frac{1}{4}$ E	160 19	S by E $\frac{3}{4}$ E	250 19	WSW $\frac{1}{4}$ W	340 19	N by W $\frac{3}{4}$ W
73 08	ENE $\frac{1}{2}$ E	163 09	S by E $\frac{1}{2}$ E	253 08	WSW $\frac{1}{2}$ W	343 08	N by W $\frac{1}{2}$ W
75 56	ENE $\frac{3}{4}$ E	165 56	S by E $\frac{1}{4}$ E	255 56	WSW $\frac{3}{4}$ W	345 56	N by W $\frac{1}{4}$ W
78 45	E by N	168 45	S by E	258 45	W by S	348 45	N by W
81 34	E $\frac{3}{4}$ N	171 34	S $\frac{3}{4}$ E	261 34	W $\frac{3}{4}$ S	351 34	N $\frac{3}{4}$ W
84 23	E $\frac{1}{2}$ N	174 23	S $\frac{1}{2}$ E	264 23	W $\frac{1}{2}$ S	354 23	N $\frac{1}{2}$ W
87 11	E $\frac{1}{4}$ N	177 11	S $\frac{1}{4}$ E	267 11	W $\frac{1}{4}$ S	357 11	N $\frac{1}{4}$ W

TABLE VII.—*Equivalent value in degrees of each fractional division of the compass to the nearest minute of arc.*

$\frac{1}{8}$ point equals.....	1 24
$\frac{1}{4}$ point equals.....	2 49
$\frac{3}{8}$ point equals.....	4 13
$\frac{1}{2}$ point equals.....	5 38
$\frac{5}{8}$ point equals.....	7 02
$\frac{3}{4}$ point equals.....	8 26
$\frac{7}{8}$ point equals.....	9 51







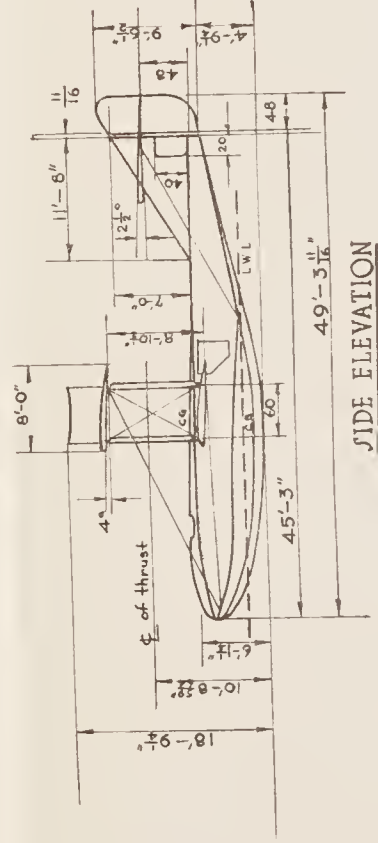
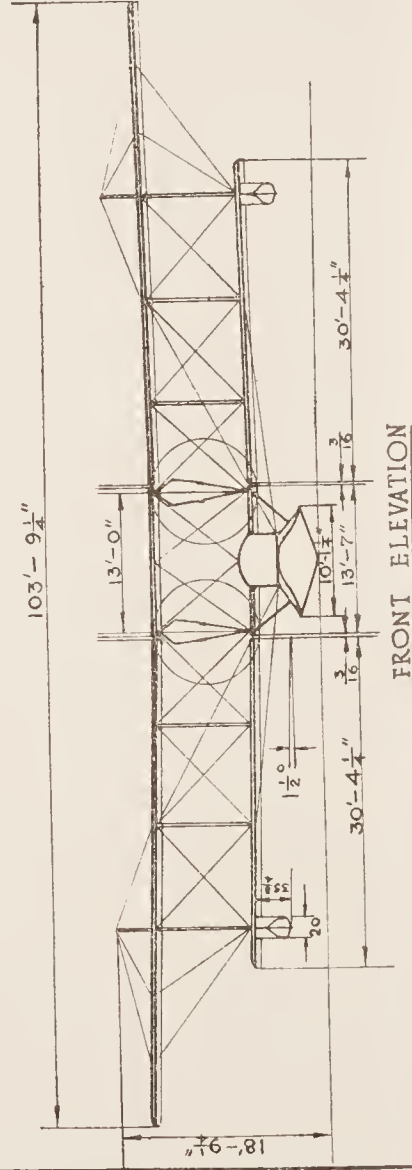
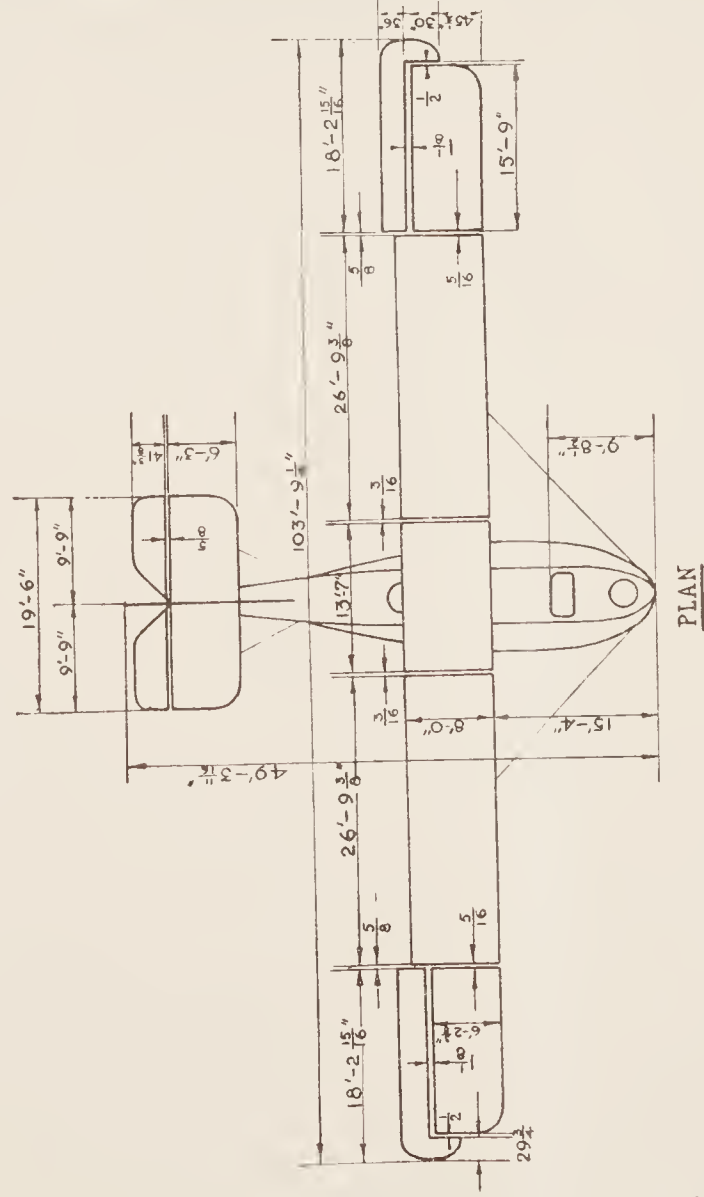


FIG. 9.—GENERAL ARRANGEMENT PLANS.

Fig. 9.—GENERAL ARRANGEMENT  
PLANS.



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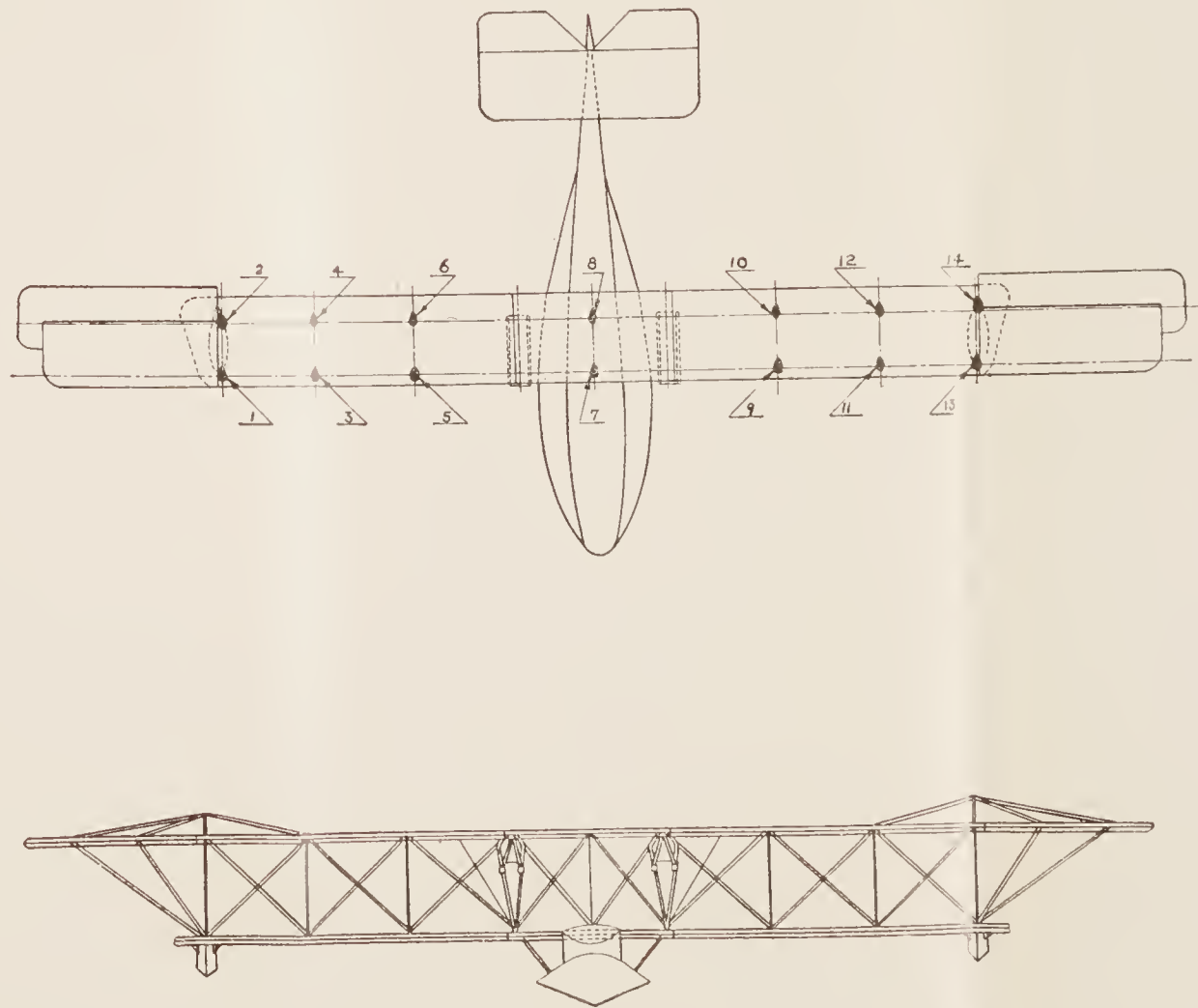


FIG. 10.—DIAGRAM OF STRUT NUMBERING.

**Fig. 10.—DIAGRAM OF STRUT  
NUMBERING.**





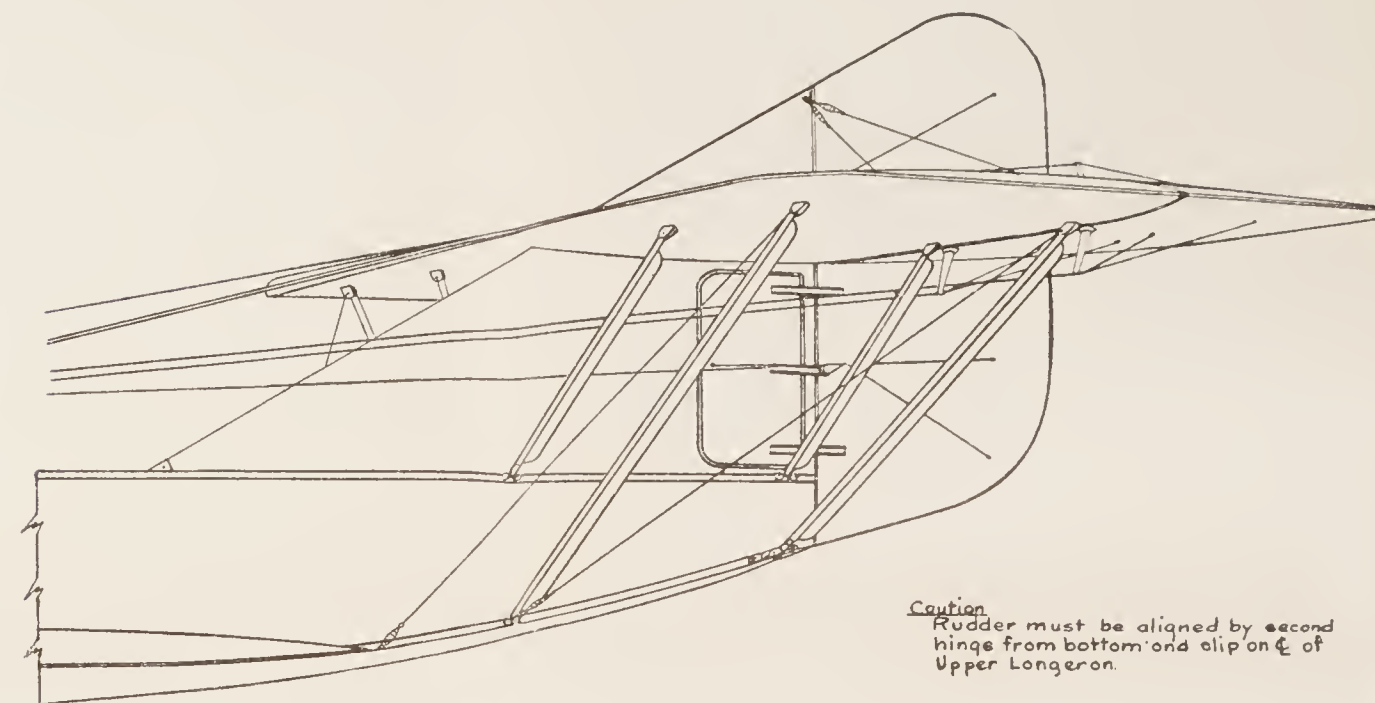
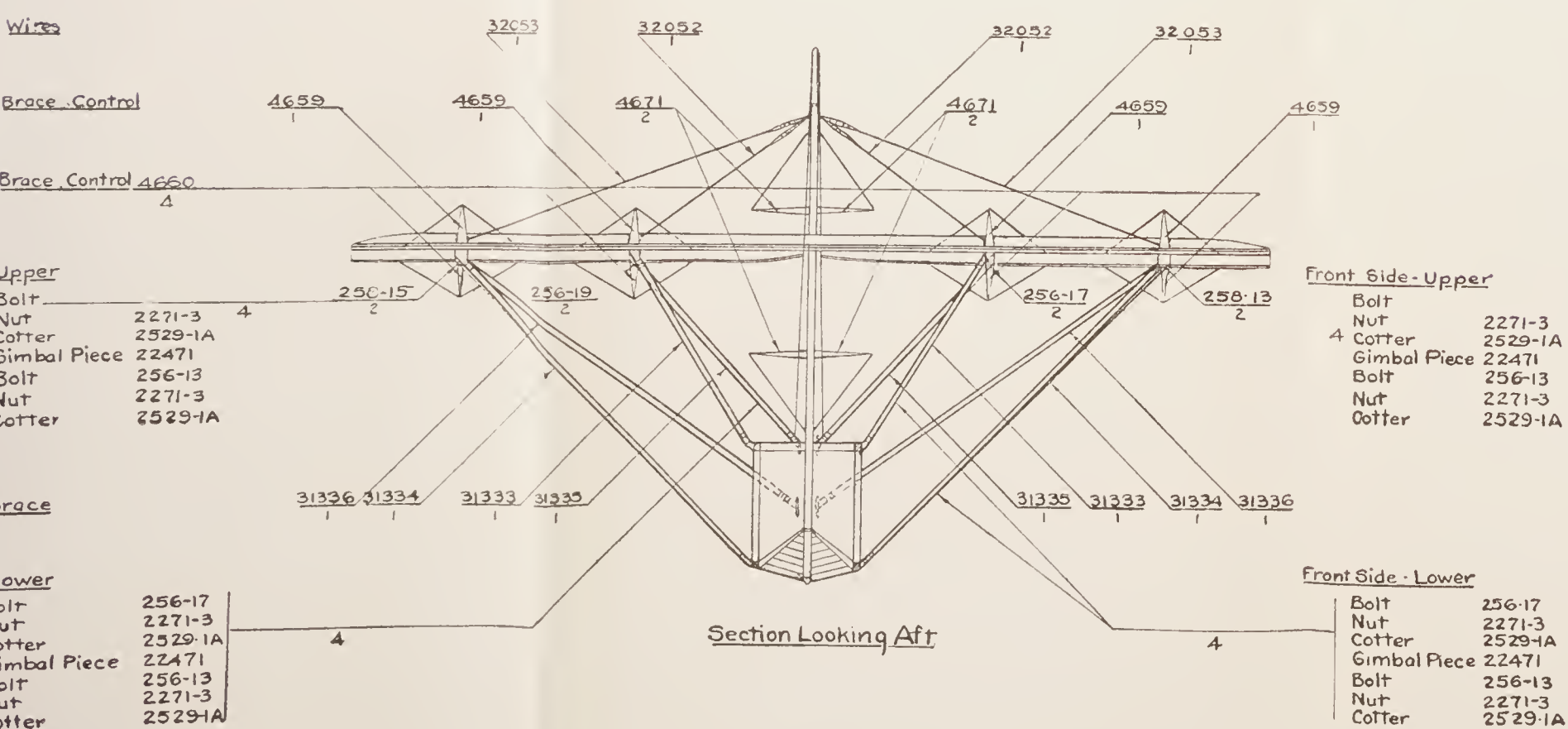
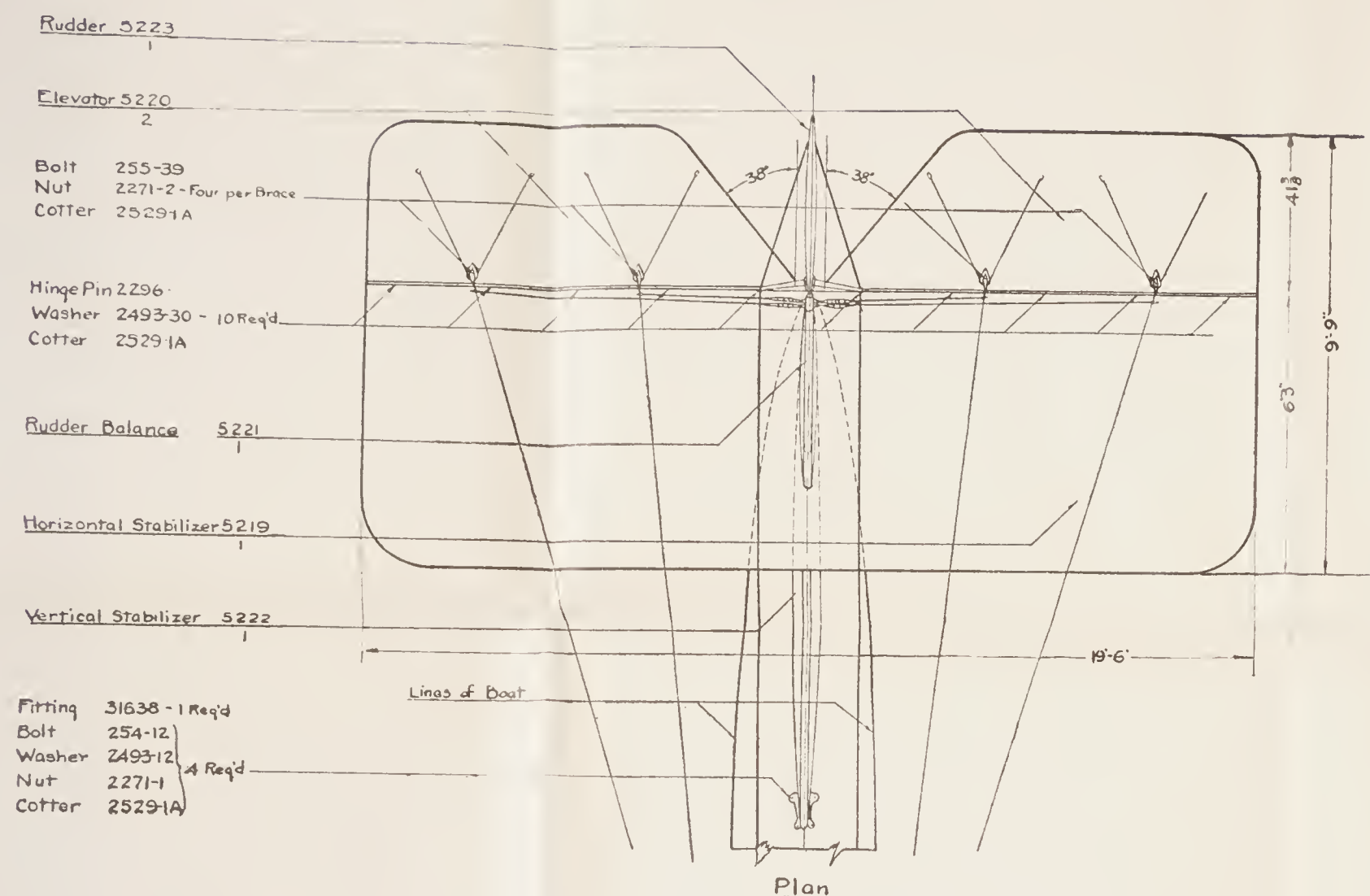


Fig. 11.—WIRING DIAGRAM OF PANELS

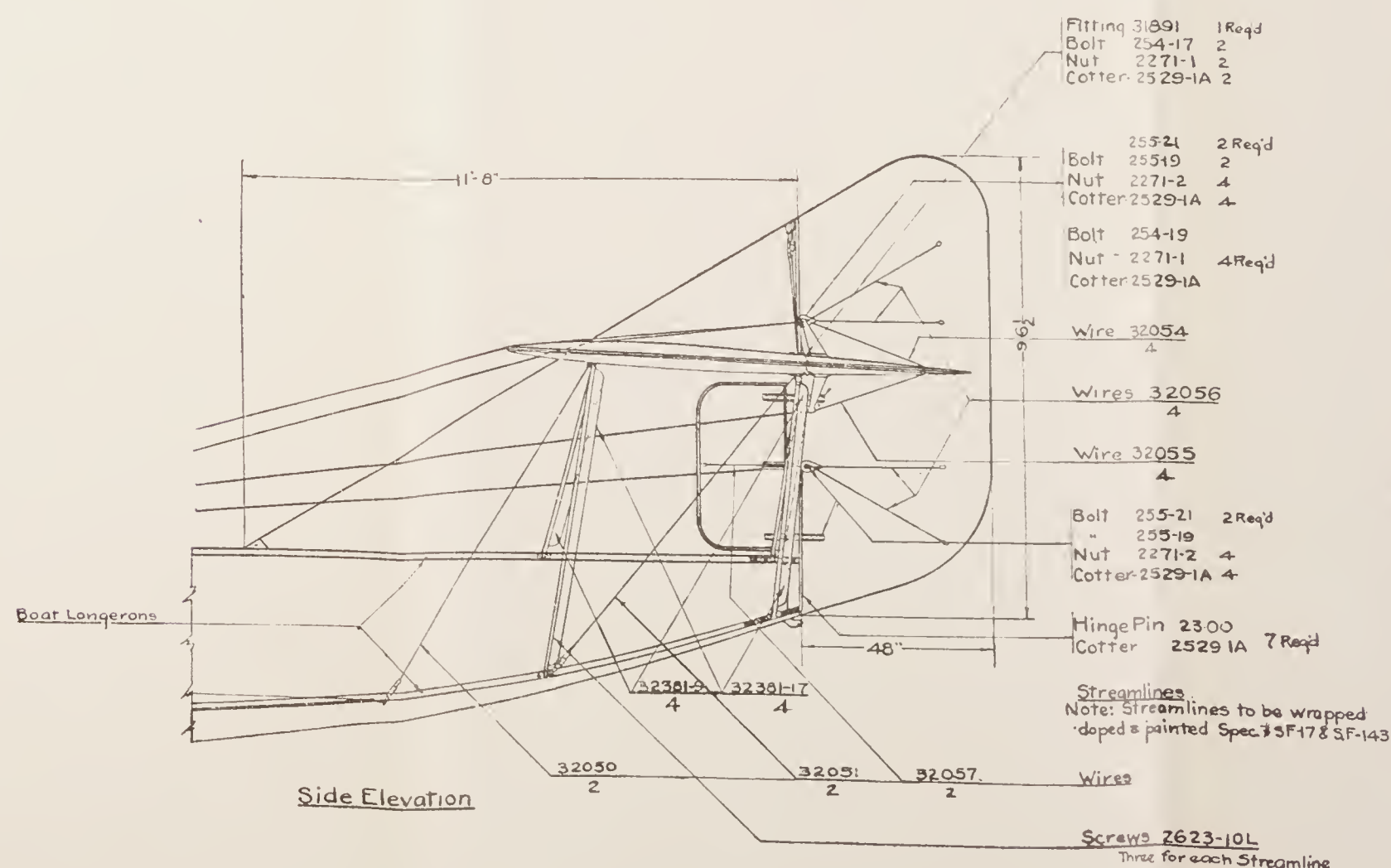


Wiring Diagram of Panels  
The diagram shows the electrical connections between the panels and the various components of the system. The connections are made through a central control unit, which is connected to the panels and the components. The diagram is a schematic representation of the wiring, showing the flow of current and the connection points for each component.





Caution  
Rudder must be aligned by second  
hinge from bottom end clip on E of  
Upper Longeron.



PART NO.	DESCRIPTION	QTY	FINISH	USED ON	DATE
2623-10L	SCREWS (FOR STREAMLINE)	24		6327	2623
2493-30	WASHER	10		6327	2493
2493-12	WASHER	4		6327	2493
2529-1A	COTTER	83		6327	2529
2271-3	NUT	32		6327	2271
2271-2	NUT	24		6327	2271
2271-1	NUT	10		6327	2271
250-13	BOLT-EYE	2		6327	250
250-13	BOLT-EYE	2		6327	250
256-13	BOLT	2		6327	256
256-17	BOLT	10		6327	256
256-13	BOLT	16		6327	256
255-39	BOLT	16		6327	256
255-19	BOLT	4		6327	256
255-21	BOLT	4		6327	255
254-19	BOLT	4		6327	254
254-17	BOLT	2		6327	254
254-12	BOLT	4		6327	254
32057	WIRING BRACE	2		6327	32057
32056	WIRING BRACE	4		6327	32056
32055	WIRING BRACE	4		6327	32054
32054	WIRING BRACE	4		6327	32054
32053	WIRING DROP	2		6327	32052
32052	WIRING DROP	2		6327	32052
32051	WIRING DRIFT	2		6327	32050
32050	WIRING DRIFT	2		6327	32050
4671	BRACE (CONTROL)	4		6327	4671
4660	BRACE (CONTROL)	4		6327	4660
4659	BRACE (CONTROL)	4		6327	4659
2296	PIN (ELEVATOR)	10		6327	2296
2300	PIN (RUDDER)	7		6327	2300
22471	GIMBAL PIECE	16		6327	22471
32059	STREAMLINE	4	See Note	6327	32059
31336	BRACE (TUBULAR)	2		6327	4297
31335	BRACE (TUBULAR)	2		6327	4297
31334	BRACE (TUBULAR)	2		6327	4297
31333	BRACE (TUBULAR)	2		6327	4297
31891	FITTING	1		6327	31891
31638	FITTING	1		6327	31638
5220	ELEVATOR	2		6327	5220
5221	BALANCE	1		6327	5221
5223	RUDDER	1		6327	5223
5219	HOR. STABILIZER	1		6327	5219
5222	VER. STABILIZER	1		6327	5222

FIG. 12.—TAIL UNIT ASSEMBLY.

Fig. 12.—TAIL UNIT ASSEMBLY.





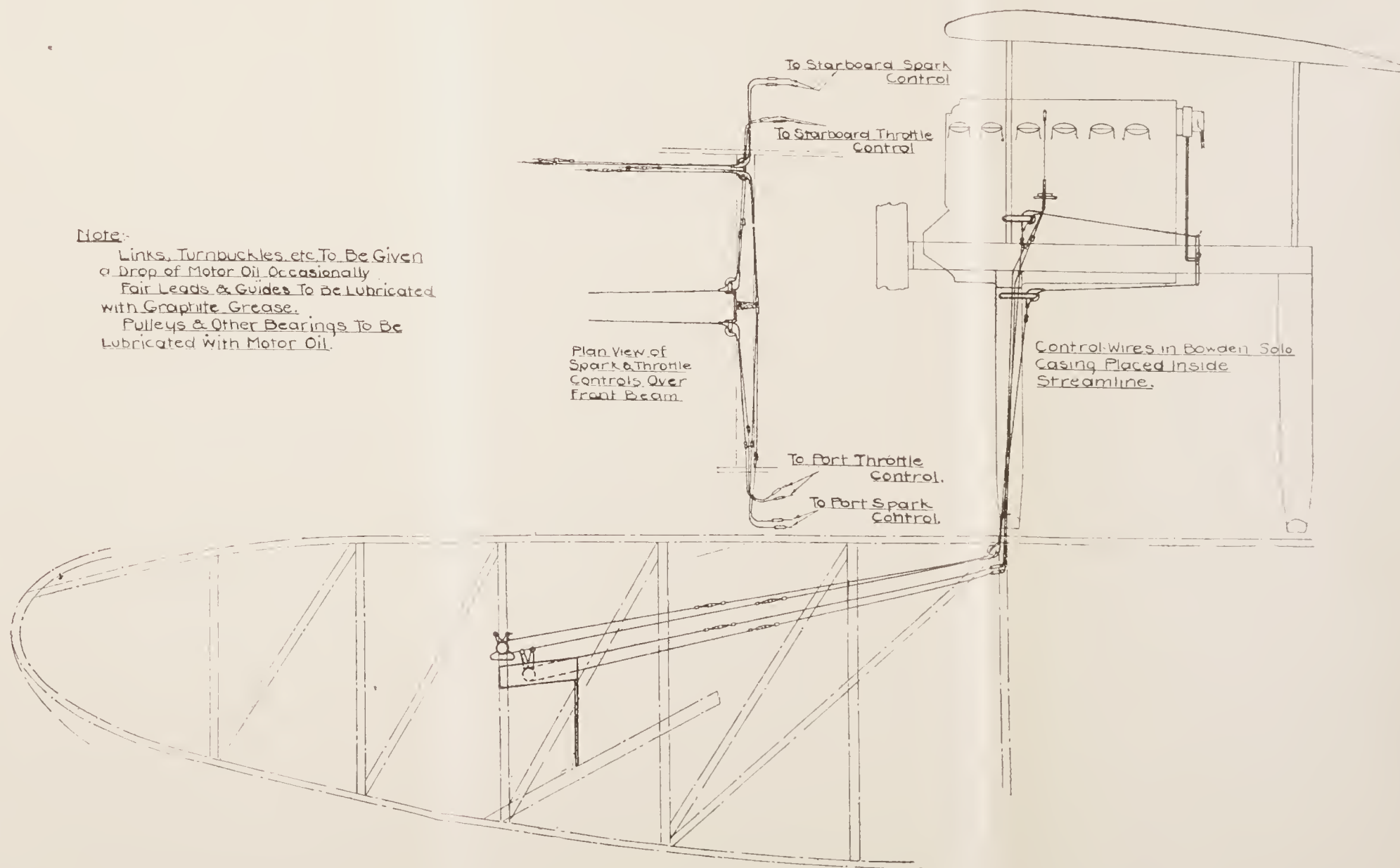


FIG. 13.—LUBRICATION CHART OF MOTOR CONTROL.

**Fig. 13.—LUBRICATION CHART OF MOTOR CONTROL.**





**Fig. 14.—LUBRICATION CHART OF SURFACE  
CONTROL.**





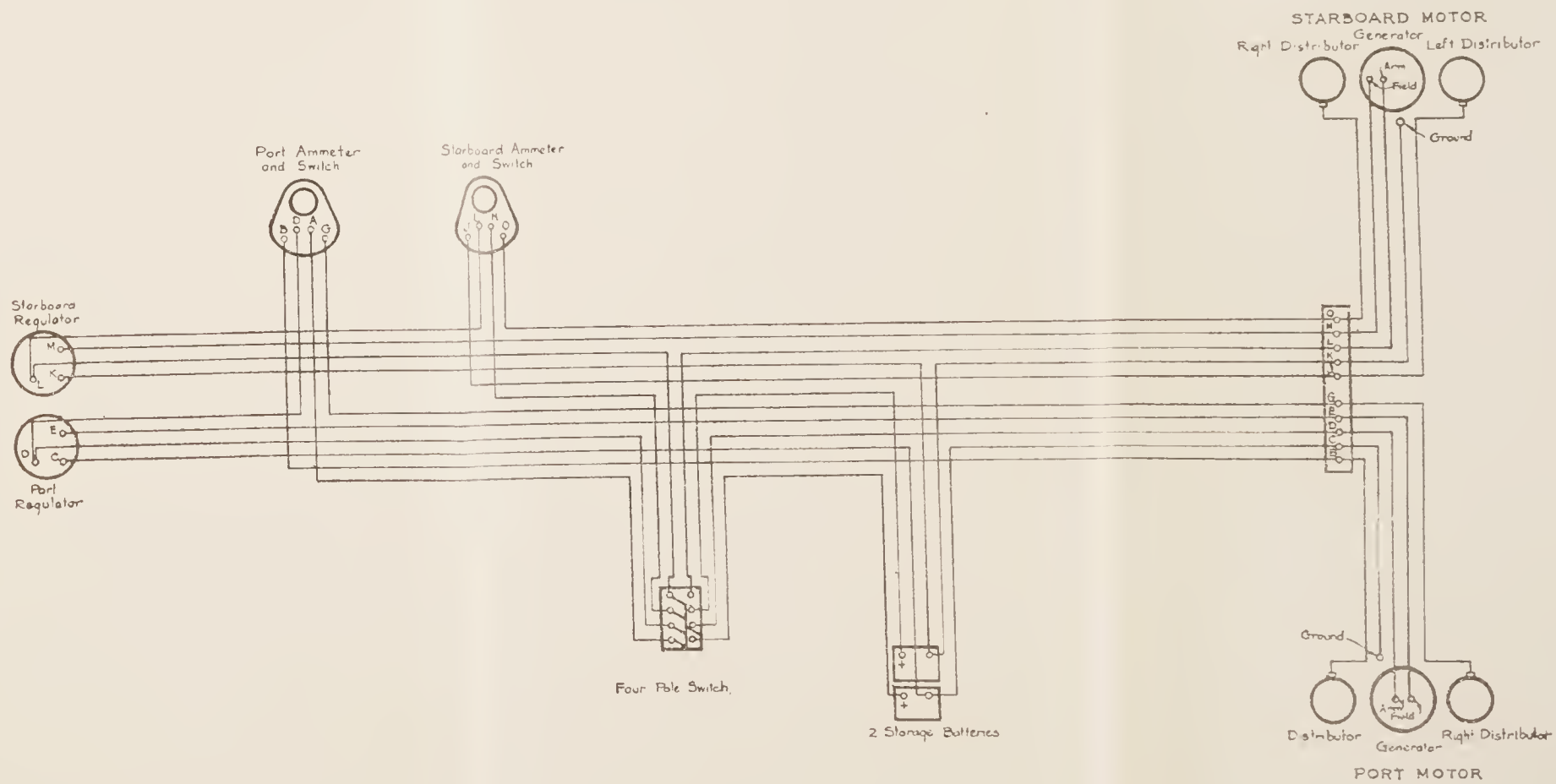
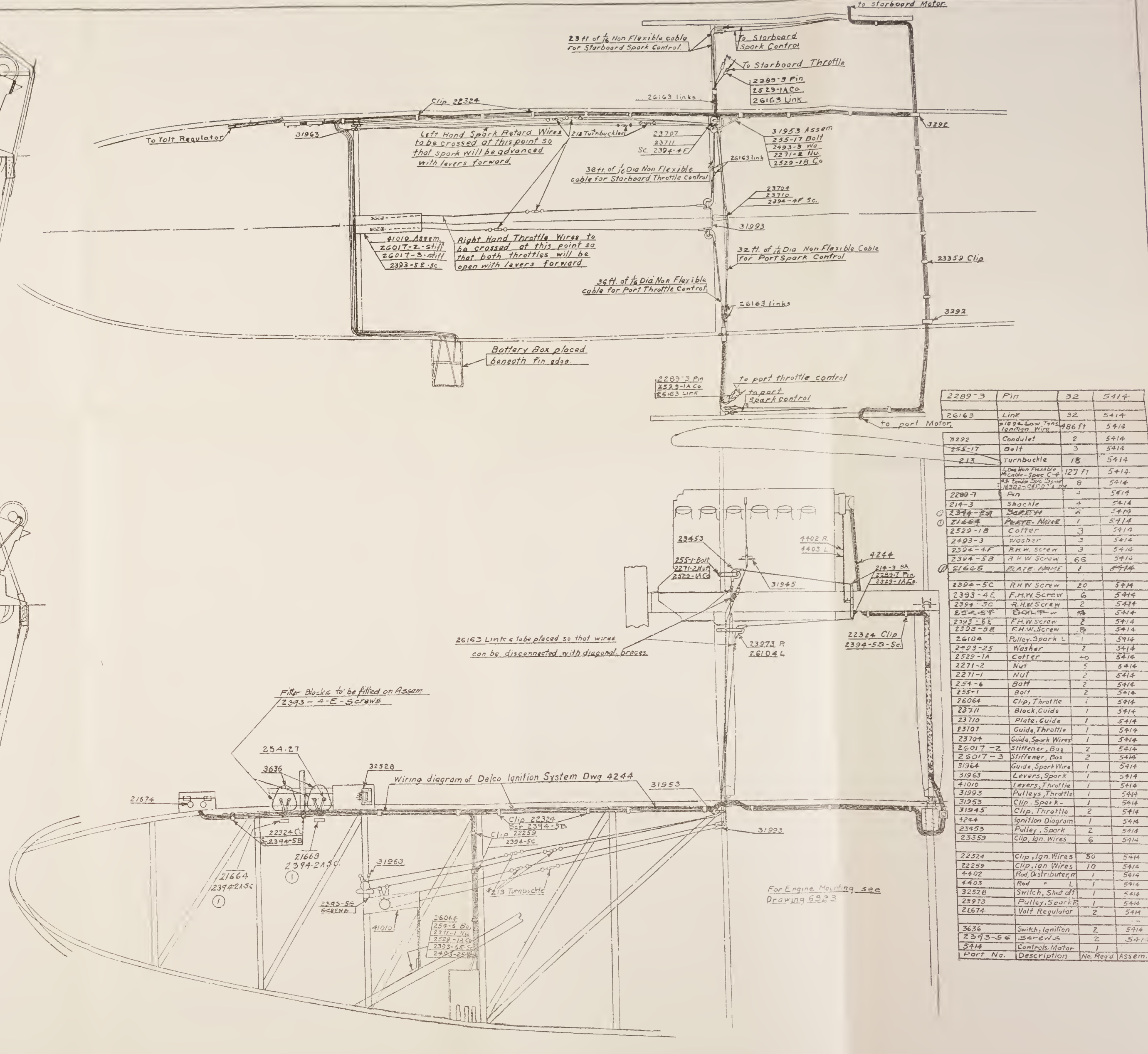
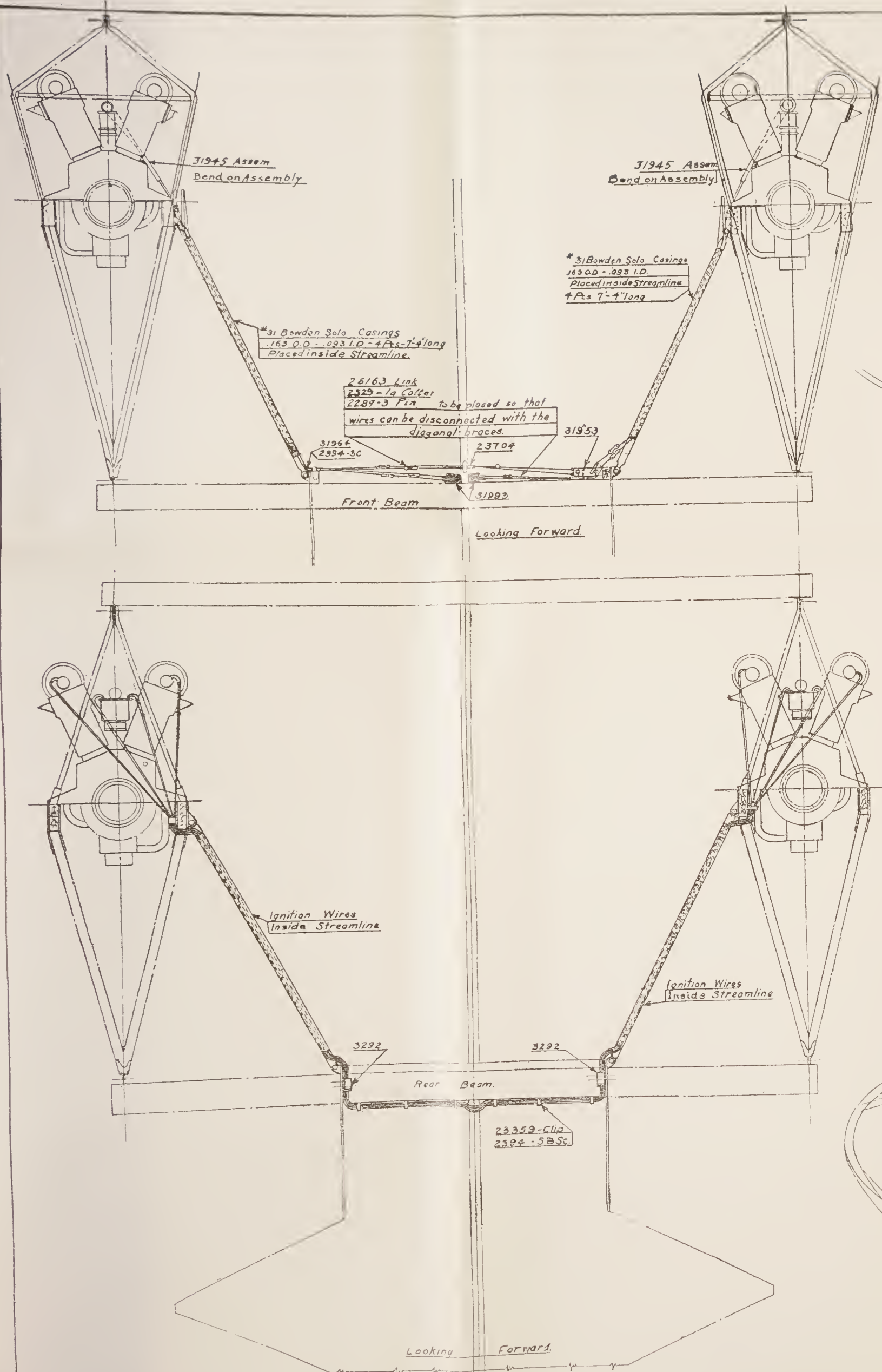


FIG. 15.—DIAGRAM OF DELCO IGNITION SYSTEM.

**Fig. 15.—DIAGRAM OF DELCO IGNITION  
SYSTEM.**









**Fig. 16.—WIRING AND MOTOR CONTROLS.**







Fig. 17—GASOLINE LINES.







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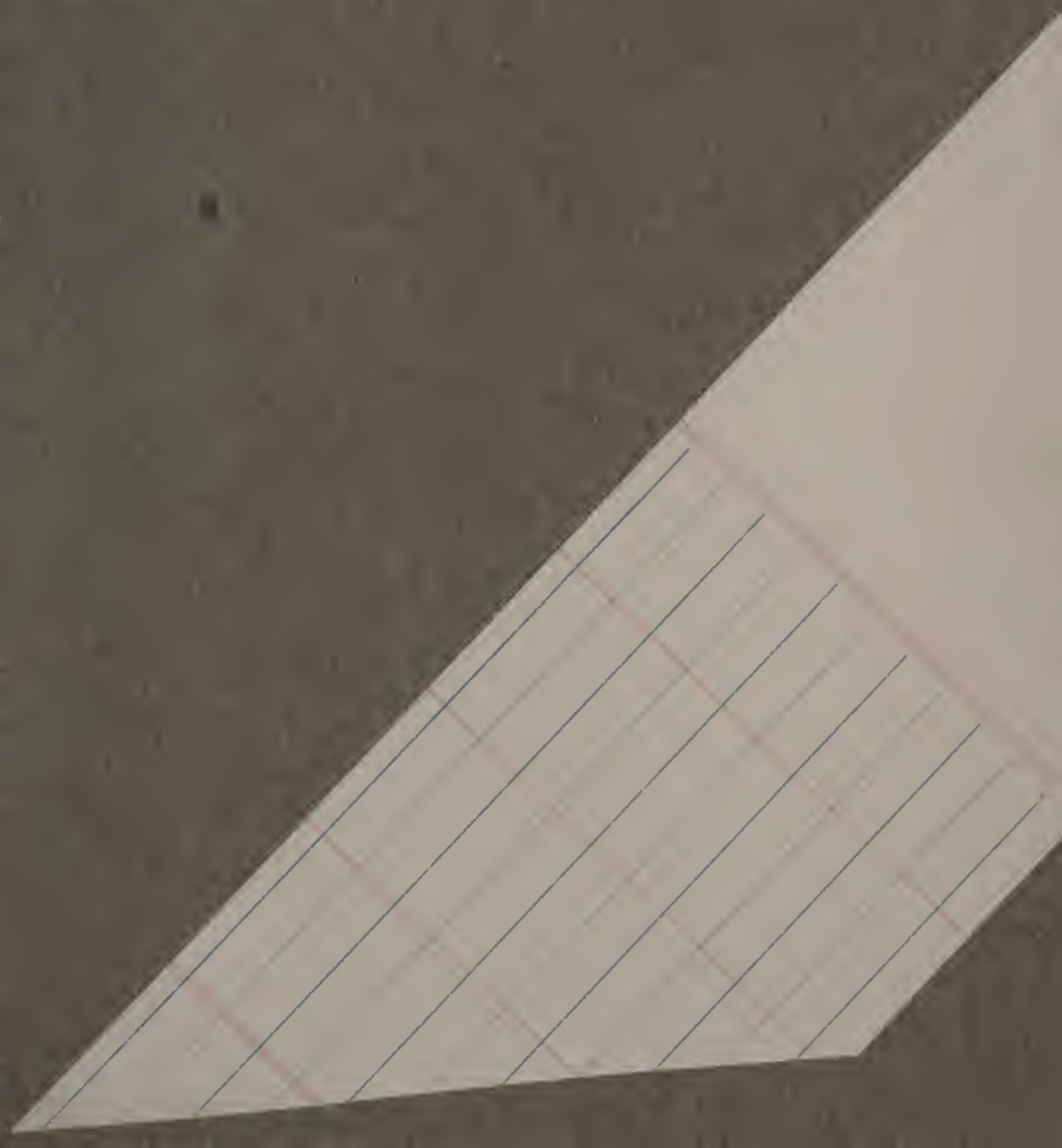
Fig. 57.—ORDNANCE INSTALLATION.











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